The AMSAT® Journal

Volume 26, No. 3 May/June 2003

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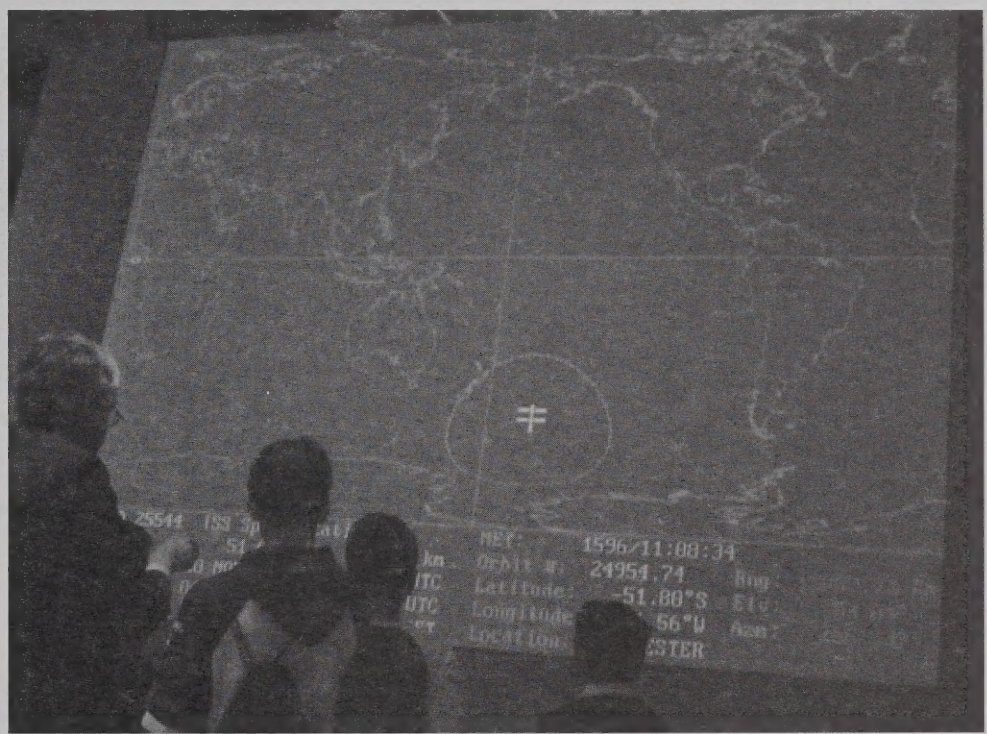

Students from the Rushey Mead Secondary monitor the progress of the ISS at the UK National Space Center as it makes its way toward Leicester. ARISS is an international project, with US participation by ARRL, AMSAT and NASA. (G6LVB Photo)

ARISS School Contact Successes Continue

ISS Contact at the UK National Space Center

By Howard Long, G6LVB

On April 1, 2003, I received an e-mail via the ARISS (Amateur Radio on the International Space Station) European reflector from Gaston Bertels ON4WF, ARISS Vice Chairman. The e-mail stated that the UK National Space Centre based in Leicester was scheduled to have a contact with the International Space Station. Although I received the e-mail on April 1 the scheduled contact was certainly genuine - no April Fool's here!

The contact was due to take place on Friday April 4 at 19:29 local time, so I offered to travel to Leicester to represent AMSAT-UK and share in the celebration. The offer was graciously

[continued on page 7]

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Apogee View

By Bill Tynan, W3XO
AMSAT-NA Board Chairman

What follows is intended to make clear to our members the financial situation facing our organization, and what has been done about it.

A special Board meeting was held in Silver Spring March 1 and 2 to address the situation. The stark truth facing your elected Board members at that meeting was that, if we had continued at the same level of income and expenses experienced in 2002, AMSAT-NA would have been out of money in a little over three years. All agreed that something had to be done if we are to continue to function as a viable organization.

Let's first examine why and how we got into this predicament, then cover what was done to get out of it.

Most important is the fact that membership has declined by almost 50 per-cent from its peak of almost 8,000 during the mid 90s. There are a number of reasons for this. One may be the demise of AO-13 and the delayed launch of Phase 3D, now AO-40. The fact that AO-40 did not live up to all of its prelaunch promises, may have contributed as well. Surely, the downturn in the economy, particularly the high tech sector, is a further factor. Many of our members, particularly those employed in tech related industries, probably don't have the jobs they did a few years ago. In addition, many also cite a declining interest in radio communication and commensurate concentration on computer related activity as another possible cause. Whatever the reasons, the fact is that our membership is significantly less than it was a few years ago. But, merely identifying causes, does not solve the problem. The Board concluded that we must find ways to increase membership as well as various means of increasing revenue from other sources.

In addition to a reduction in membership, donations have been insufficient to support our various projects; currently Echo, Eagle and ARISS. Membership dues are sufficient to cover the cost of running the organization, even at their current level. But, projects must be funded from other sources such as donations. However, many of the same factors which have caused a reduction in membership, are to blame for a drop in donations. Certainly, the fact that so many gave so much for so long during the construction of Phase 3D has inhibited additional donations now. The President's Club has helped alleviate this problem somewhat, but it falls short of adequately funding the above projects. The remainder must come from our reserves. Therefore they are diminishing.

The recent meeting began with these hard facts, to which all Board members agreed. Then we attempted to identify means of keeping the organization going as well as proceeding with our projects.

First, we attempted to identify ways for increasing revenue. Some of the ideas advanced included applying for government and/or private grants to fund special projects, for example, education. In this regard, we have recently been wrestling with means by which various qualified AMSAT volunteers might be able to assist universities with their small satellite programs. Might we obtain grant money from the U.S. Department of Education, or some foundation, to provide funding for such an endeavor? We don't know, but intend to find out. Other ideas tabled involved building satellites for organizations which wish to conduct scientific experiments requiring access to space. This too, will be followed-up on a continuing, high priority basis.

Other thoughts included going to corporations and foundations to fund our various projects. Though we have not been overly successful with such efforts in the past, we concluded it worth another try. To aid this, it was agreed that we will publish an Annual Report which can be placed in the hands of key people to illustrate what AMSAT is and document its accomplishments.

Another important area discussed was a campaign to urge members to remember AMSAT in their wills. Let's face it, we're all getting older and none of us will be around forever. So why shouldn't we leave something so that future hams are able to enjoy building and using satellites as we have?

These were some of the principal ideas offered for raising the kind of money we need to fund our projects. As I have already noted, dues can be expected to provide enough revenue to run the organization, including production of the *Journal*; but

Continued on Page 4

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projects, such as building new satellites, require other sources of income.

The Board also spent considerable time discussing means of cutting expenses. One suggestion was to offer members the option of receiving their *Journal* via electronic means. The details of accomplishing this are being investigated. If a significant number opt for it, we can save quite a bit on postage and some printing cost.

It was observed that many organizations are cutting staff in order to stay afloat these days. We discussed this approach but, concluded that, since AMSAT-NA has only one paid employee, Martha, it was clear that this is not a viable option for us.

We also discussed our various projects in great detail.

ARISS is one on which we have been spending a considerable sum each year, mostly for travel. Since it is an international program, foreign travel is an absolute necessity. In this regard, Frank Bauer, KA3HDO, VP Human Spaceflight, stated that he plans to reduce the number of in-person ARISS meetings, which should decrease expenses somewhat.

Everyone agreed that we are committed to Echo. For one thing, we are contractually obligated to make certain payments. Furthermore, the spacecraft is almost complete. All were in accord that we would not want to build a satellite, then not launch it. So, the Board's conclusion was that there is little we can do to reduce Echo expenses. President Robin Haighton, VE3FRH, led off the Eagle discussion, noting that several factors have made it advisable to stretch out the development of this satellite. One is the ongoing European P3E project. Though the planned orbits of the two spacecraft are dissimilar, Eagle and P3E are to accomplish much the same mission. Since many of our members are liable to feel that P3E will serve their needs for a high altitude VHF/UHF spacecraft, there is a question regarding our ability to raise sufficient funds to support Eagle. Thus, it was agreed that the Eagle project should be stretched out. If P3E is successful, which we all hope it will be, satellite operators will have a high altitude VHF/UHF facility for some years to come. At that point, we can reassess Eagle to see where it fits into the Amateur Radio satellite picture. If P3E is, for some reason, not successful; we can go full bore on Eagle with a reasonable expectation of receiving sufficient donations to support it. So, in light of these considerations, your Board agreed to reduce Eagle activity to the bare bone for the next year or so. This action represents a substantial saving.

With these actions, it was concluded that AMSAT-NA will be solvent for several years longer than it would have been at current levels of expenses and income. This should provide us enough time for some of the longer term potential revenue streams to begin to be felt. Unfortunately, one of these is the aforementioned bequeathment by members and friends who are leaving us. As we want all of our members to be around as long as possible, this is one revenue stream we are not anxious to have begin right away. Nevertheless, now would be a good time to for all of us to make plans for disposition of our assets with due regard to the organization which has brought so much to us.

The long-term continuance of AMSAT-NA's ability to build new exciting satellites depends on what all of us do now. Therefore, everyone should do whatever he or she can to keep this vital organization viable so we, as well as those coming after us, are able to enjoy amateur satellites as we have. If you haven't already joined the President's Club, please do so right away. If you've already joined, please consider increasing your level of participation. Convince your friends to join AMSAT. If you know of any companies or foundations which might be persuaded to contribute to one or all of our projects, call or e-mail the office and let Martha know about it. The same goes for rich hams you may know, who may not be especially interested in satellite operation but, might be persuaded that a contribution to AMSAT, or making it a beneficiary in their wills, would serve the long-term interest of Amateur Radio.

Bert Rollen (right), K4KR, presents a $300 check as a donation by the Southeastern VHF Society to AMSAT. Bill Tynan (left), W3XO, AMSAT Board Chairman, gratefully accepts the the generous SVHFS donation on behalf of The Radio Amateur Satellite Corporation.

All of us must do whatever we can. That means you, me and all AMSAT-NA members. If we all pitch in AMSAT-NA will not only be around, but will continue building satellites for years to come. ■

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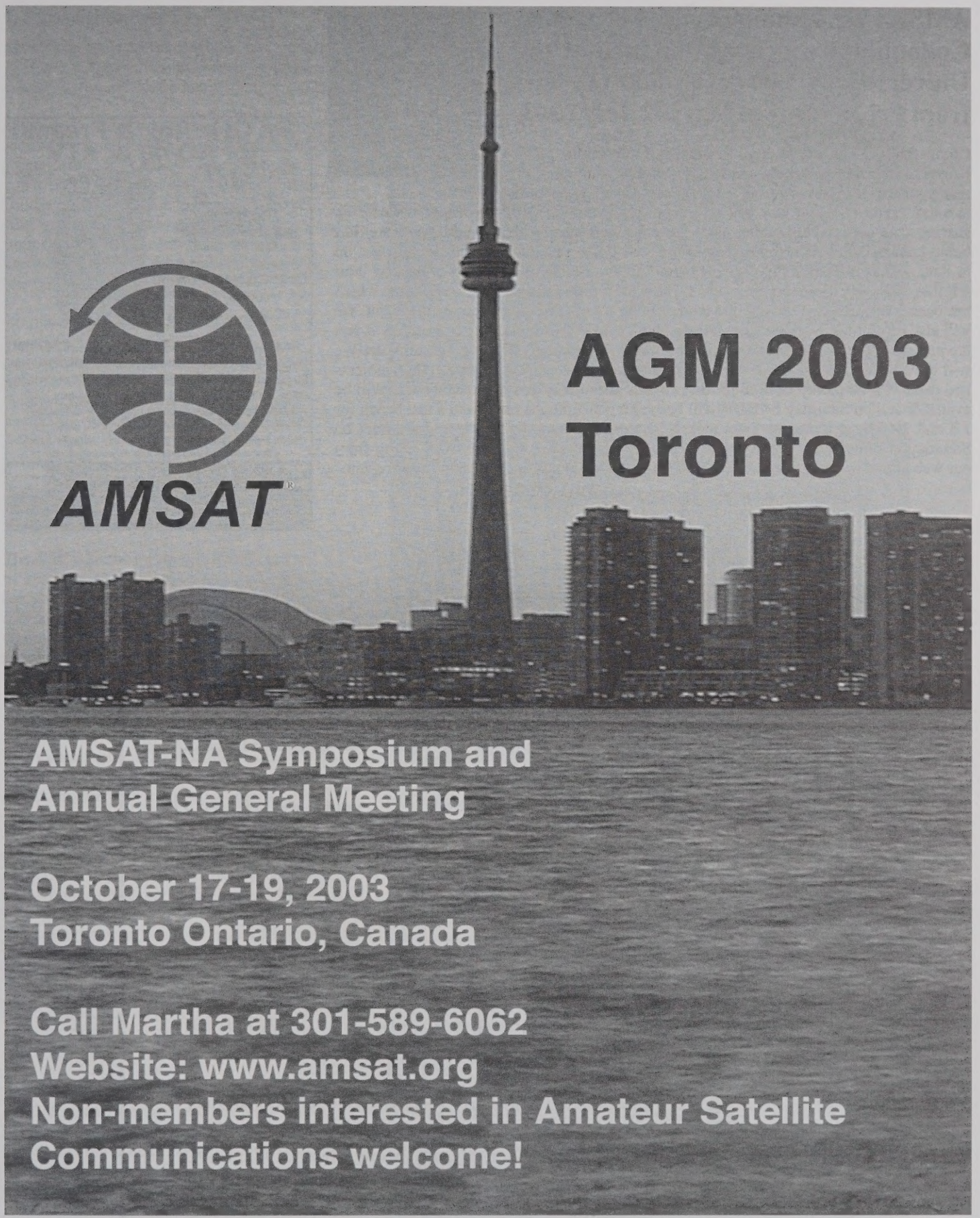
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AMSAT UK announces the 18th Annual Colloquium which will be held at the University of Surrey, Guildford, UK. from Fri 25th July to Sun 27th July 2003.

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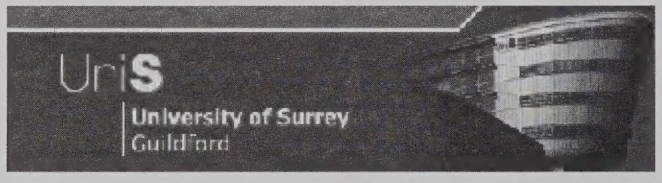

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accepted, so I jumped in the car on a gloriously sunny Friday afternoon and headed up the M1 to the NSC.

Obtaining a scheduled contact with the ISS requires a great deal of organization and preparation, as well as some patience; contacts can take up to two years to come to fruition. When the call comes, organizers only get a couple of weeks' notice, so it's important to have everything thoroughly prepared, tested, and ready for action before this time.

On this occasion the NSC's Amateur Radio Society, in conjunction with the NSC itself and the local Rushey Mead Secondary School, laid on an extraordinarily well-organized event. I was somewhat surprised by the lack of panic in the hours and minutes leading up to the contact itself!

By 19:00 the press had arrived, taking photographs and interviewing some of the lucky ones.

The NSC is fortunate enough to have access to excellent professional audio and visual resources, which were used with great effect throughout the event. There was even an enormous 12' projection screen showing the position and footprint of the ISS in real time.

When the ISS reached AOS (acquisition of signal) as it came above our horizon, I could feel for John G7HIA (who was operating) as he listened for the ISS on the downlink. We began to hear the ISS, but John had difficulty on the primary uplink and switched to a secondary uplink frequency. I was monitoring the uplink and I was probably as nervous as John was! Things were very tense, and after a couple of calls we nearly lost the ISS, with them wishing us "all the best," but by a good deal of luck and some sound judgement on John's part, he returned to the primary uplink frequency to which we got the astonishing reply "GB2NSC NA1SS, got you loud and clear"! Eleven very lucky students asked their questions and received answers from astronaut Ken KD5JBP in quick succession.

About three minutes prior to predicted LOS (loss of signal), we lost contact. This may have been due to polarization changes (we were running linear polarization). But contact had been made. We were totally ecstatic!

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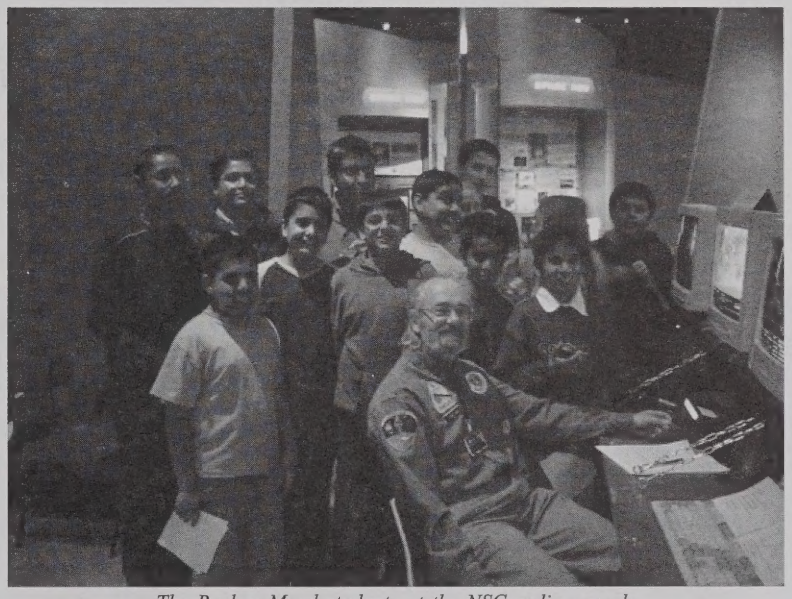
Getting ready to talk with the astronauts.



The Rushey Mead students at the NSC radio console.

We did it!

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For Andy G0SFJ it was not the end of the evening - he still had to travel up to Nottingham to do an interview for broadcast radio.

It is a tribute to all those at the NSC-ARS, the NSC, Rushey Meade Secondary School, ARISS, ARISS-EU, and of course the astronauts themselves that this kind of contact can take place. Apart from the event itself, there is an enormous amount of planning which goes unseen. I cannot think of anything more hands-on and inspirational than the ARISS program in introducing the youth to the worlds of science, space and amateur radio.

Audio & Video:
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"Sox" Blasts Through 30 Questions From New Jersey Students Via Ham Radio

International Space Station Expedition 6 Crew Commander Ken Bowersox, KD5JBP, deftly managed 30 questions put to him this week during a 10-minute Amateur Radio contact with 15 New Jersey students. The number of questions answered could be a record for a school group contact. The April 14 QSO with youngsters at Lounsberry Hollow Middle School http://www.vtsd.com/lhms/ in Vernon was arranged by the Amateur Radio on the International Space Station (ARISS) program. Bowersox–who's known as "Sox" within NASA's Astronaut Corps–answered the obviously well-rehearsed students' questions as quickly as they asked them.

Control operator John Santillo, N2HMM, reports that teachers at the northwestern New Jersey school were ecstatic about the smooth and speedy banter between Bowersox and the students. Reporters from a New York City TV station (WNBC-TV, channel 4), a local cable channel and two newspapers covered the event.

ARISS is an international project, with US participation by ARRL, AMSAT and NASA. ■

(Story credit to ARRL Letter Vol. 22, No. 16)

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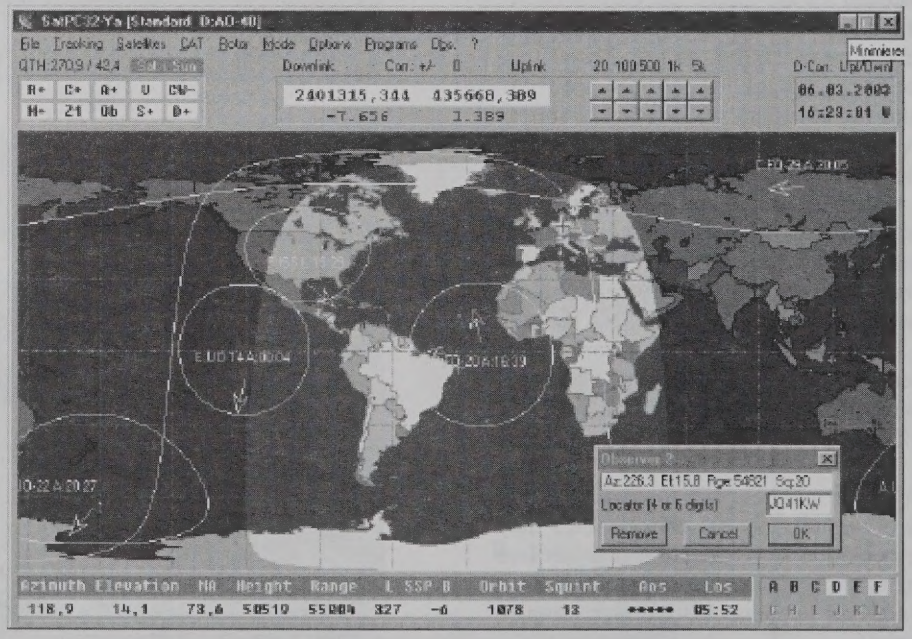


Satellite DX by Wayne Estes, W9AE

This is the second edition of what will hopefully be a regular feature in the *AMSAT Journal*.

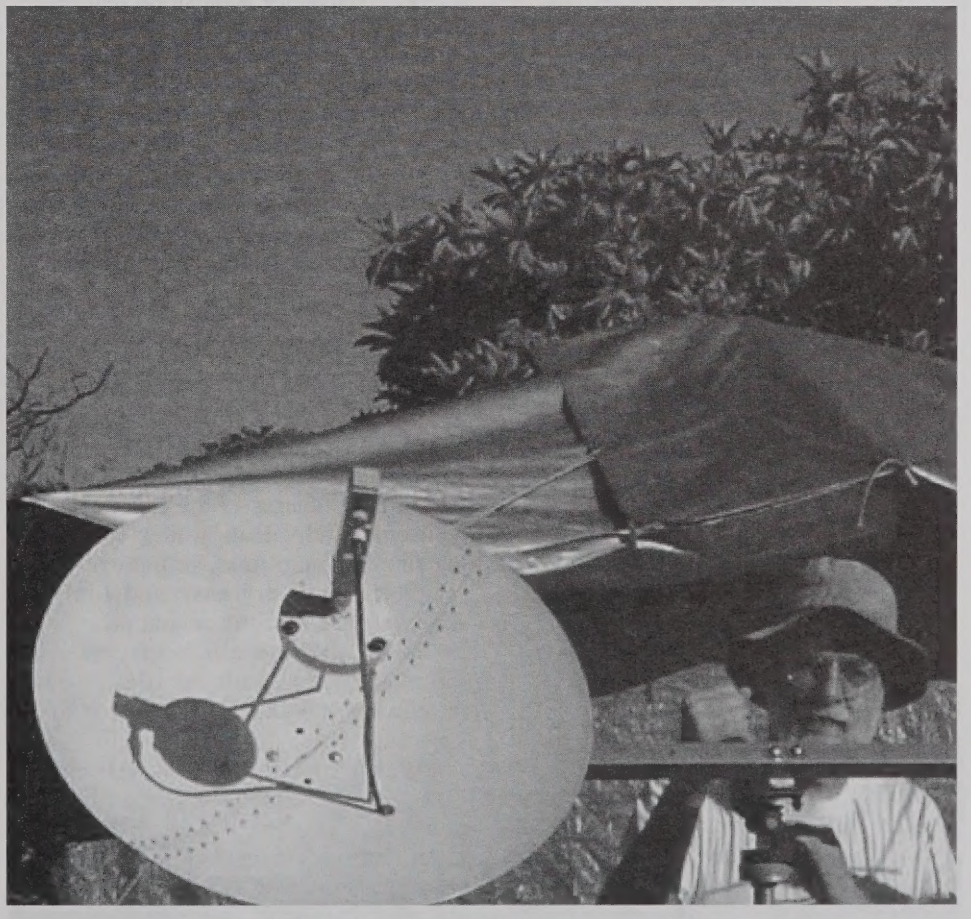
Recent DXpeditions

Three major satellite DXpeditions took place in the last few months.

FG/W9AE (Guadeloupe, grid FK96) was active for three orbits on AO40 from February 22-26. The author made 177 contacts with 24 DXCC entities, 34 states, and 125 grids. A steep hill to the west obstructed the window to Australia, and thick tropical foliage frequently made the downlink hard to hear with a G3RUH 2-foot dish. The 39- inch 7x7 UHF Yagi gave a surprisingly strong uplink with 50W from a FT-847 and a DYC-817 speech processor. This was a vacation operation — ham radio had to share time with many activities. The author expects to mail QSL cards by the end of May (see photo).

QSL card for the FG/W9AE AO40 operation in Guadeloupe.

VP6DIA (Ducie Island, grid CG75) was active on AO40 for a few days in early March. The operator was Doug Faunt N6TQF. This was the first-ever satellite operation from Ducie. Doug made 125 AO40 contacts using an FT-847, G3RUH 2-foot dish, and the rear 18 elements of a 436CP30 yagi. Doug's satellite operating time was limited because he also operated the huge HF pileups. The photo shows that Doug cut his dish in half to fit the satellite antennas into a small package. The antenna tripod was weighed down with bronze spikes from the ship Acadia which wrecked off the coast of Ducie Island in 1881. Send QSLs and contributions to JR2KDN.



Doug Faunt N6TQF adjusts his A040 antennas on Ducie Island.

FM/F6CBC (Martinique, grid FK94) was active on AO40 for less than 8 hours on April 12. Jean F6CBC was in Martinique for business, so he had little advance notice or time to operate. Nevertheless, Jean made 77 contacts with 17 countries. The antenna was a 1.2m cloth umbrella dish designed for Inmarsat use, and the dish had dual helixes for S-band downlink and L-band uplink. The 70W L-band amplifier provided a satisfactory uplink under squint conditions that were extremely poor for L-band. Jean used a filter on the downconverter input, and found that the SSB Electronics downconverter was much more resistant to L-band signals than the DB6NT downconverter.

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Future DXpeditions

VP9/N0JK (Bermuda). Jon N0JK plans to operate FM satellites from Bermuda (VP9) before and after the June 14-16 ARRL VHF contest.

At press time, AO40 is in a dormant phase. No new AO40 DX operations have been confirmed at this time. Tentative plans are being made for a satellite DXpedition to Madeira (CT3). Also, a rare African country may be activated on satellite later this year. Please send plans for future DXpeditions to w9ae@amsat.org. Feel free to contact the author if you are interested in satellite operations from a rare country and need operating tips or loaner equipment. And don't forget that many rare countries can be activated on the FM satellites as well.

New DX Stations Heard

8J1RF (Fuji Dome Base, Antarctica, grid KB92). The operator is Obi JA0WJN; QSL via the JARL bureau. Obi's free time to operate is limited: Weekdays from 0930-1000 UTC, 1230-1300 UTC, and 1630-2100 UTC; Saturdays after 0930 UTC, and Sundays after 0700 UTC; These times are seldom convenient for satellite operators in the Americas, as evidenced by the fact that only 11 of his first 312 AO40 contacts were with stations in the Americas. Fortunately, Obi will be in Antarctica until next January, so there will be more chances to make contacts on AO40.

5N0EVR (Nigeria, grid JJ16). QSL via Vladimir's home call LZ3XV. He is QRV on AO40, mostly on Sundays.

A22BP (Botswana, grid KG25). QSL via Nori's home call 7M1WBP.

QSLS Received

VP5/W6XK (Turks and Caicos)
6Y5/W6FOG (Jamaica)
7X0DX (Algeria)

DXpedition Sponsorship

AMSAT-UK has announced that it will consider sponsoring future satellite DXpeditions. The objective is to encourage more major HF DXpeditions, including satellite operations. For more information, contact g3rwl@amsat.org ■

AMSAT-NA Space Symposium 2nd Call for Papers

The 2003 AMSAT-NA Annual Symposium is scheduled for October 17-19, 2003 in Toronto, Ontario, Canada. This is the first call for papers to be presented at the 2003 Symposium. Papers may be presented by the author during the Symposium, or simply offered for inclusion in the Symposium Proceedings publication.

The subject matter should be of general interest to Amateur Radio operators involved in satellite communications. Suggested topics include:

- Operating techniques
- Antenna design and construction
- Spacecraft design and construction
- Current mission status
- Proposed satellite missions
- Telemetry acquisition and relay

A brief abstract of the proposed paper should be submitted as soon as possible. The final date for abstracts is June 15, 2003. Copy ready papers must be received by August 15, 2003. Electronic submittal is preferred (MS WORD format). Please email your electronic submittals to Wayne Chandler at ve3whc@amsat.org ■

Announcing the New AMSAT EchoLink Conference Server

EchoLink is a "Voice over IP" system that lets amateur radio operators (exclusively) talk to each other over the Internet. It can be used by individuals at their computers, via simplex radio links, or through linked repeaters. It's very easy and fun! The software you need to communicate with EchoLink and more information about EchoLink are both available from http://www.echolink.org.

A conference server allows many operators, links, and repeaters to share the same conversation. The new ***AMSAT*** conference server provides a place for satellite operators worldwide to congregate and chat. The server is up continuously. All amateurs are invited to connect and give it a try.

More information about the *AMSAT* EchoLink conference server is available at http://www.amsat.org/echolink/ .

73 -Paul
kb5mu@amsat.org
AMSAT VP, Electronic Publications ■

All Ham Crew Aboard ISS Expedition 7

NASA launched veteran Russian cosmonaut Yuri Malenchenko, RK3DUP, and veteran NASA astronaut Ed Lu, KC5WKJ, as the International Space Station's Expedition 7 primary crew. Malenchenko, 41–who will be the crew commander–and Lu, 39, will be the first two-person ISS crew increment and the first primary crew to travel to the space station on a Russian Soyuz spacecraft.

Russian cosmonaut Alexander Kaleri, U8MIR–originally set to be the third person on the new crew–and NASA astronaut Mike Foale, KB5UAC, are the back-up crew members for Expedition 7. All four have been training in Russia.

Originally scheduled to return in March aboard the space shuttle Atlantis STS-114 mission, Expedition 6 Commander Ken Bowersox, KD5JBP, Flight Engineer Nikolai Budarin, RV3FB, and NASA Space Station Science Officer Don Pettit, KD5MDT, returned to Earth aboard a Soyuz craft in May. They have been in space since November 23. The fresh crew will remain in space until October, when a new crew will be sent up.

ARISS International Chairman Frank Bauer, KA3HDO, has said that despite the reduction in crew size, NASA has told the ARISS team that it may continue to schedule one or two ARISS school group contacts per week. ARISS school contacts typically go on hiatus during a crew changeover, however. The grounding of the shuttle fleet also means that plans to transport new ham gear to the ISS will have to be put on hold.
(ARRL Letter) ■

Continued on Page 29

2003 AMSAT Field Day Competition and Rules

By Bruce Paige, KK5DO

It's that time of year again: Summer means Field Day! Each year the American Radio Relay League (ARRL) sponsors Field Day as an emergency-preparedness exercise. For 2003 the event takes place during a 27-hour period on the fourth full weekend of June, from 1800 UTC on Saturday June 28, 2003 through 2100 UTC on Sunday June 29, 2003. The Radio Amateur Satellite Corporation (AMSAT) promotes its own version of Field Day via the HAMSATS, held in concurrence with the ARRL event. Those who set up prior to 1800 UTC on June 28 can operate only 24 hours.

Photo 1: The K2BAR Field Day Station

If you are considering *only* the FM voice satellites like UoSat-OSCAR-14 or AMRAD-OSCAR-27 for your HAMSAT Field Day focus, reconsider unless you are simply hoping to make one contact for the ARRL rules bonus points. In 200, the congestion on UO-14 and AO-27 was so intense that some stations running over 100 watts on the two-meter uplink to high-gain Yagi antennas could not make a single contact. We will repeat the one-QSO-per-FM-satellite rule this year, as this plan worked so well in 2001. However, we are going to add the International Space Station to the one QSO limit. You will be allowed one QSO if the ISS is operating voice. You will also be allowed one digital QSO with the ISS and PCSat.

The format for the message exchange on the ISS or PCSat packet is an unproto packet to the other station (3-way exchange required) with all the same information as normally exchanged for ARRL Field Day, i.e. e.g.:

W6NWG de KK5DO 2A STX
KK5DO de W6NWG QSL 5A SDG
W6NWG de KK5DO QSL

If you have worked the satellites on Field Day in recent years, you may have noticed that good contacts can be made on some of the less-populated, low-earth-orbit satellites like Fuji-OSCAR-20 and Fuji-OSCAR-29. During Field Day the transponders come alive like 20 meters on a weekend. The good news is that the transponders on these satellites will support multiple simultaneous contacts. The bad news is that you can't use FM, just low duty-cycle modes like SSB and CW. AMSAT-OSCAR-10 can also be a lot of fun on Field Day if the solar panels are properly illuminated and it is in a good position in the sky. (it has not been usable lately). And, of course, the big news this year is AO-40, expected to be the most popular satellite once again. Plot some orbits and check it out.

Photo 2: John N2HMM and Walt N2WM looking over their Field Day antenna array.

Photo 3: ON5GS working FO-20

The 2003 AMSAT Field Day Rules

The AMSAT Field Day 2003 event is open to all Amateur Radio operators. Amateurs are to use the exchange as specified in ARRL rules for Field Day. The AMSAT competition encourages the use of all amateur satellites, both analog and digital. Note that points will not be credited for any contacts beyond the *one* allowed via each single-channel FM satellite. Operators are encouraged not to make any extra contacts via these satellites (ex: UO-14 & AO-27). CW and digital contacts are worth three points as outlined below.

1. Analog Transponders

ARRL rules apply, except that:

- Each phone, CW, and digital segment *on each satellite transponder* is considered a separate band;

- CW and digital (RTTY, PSK-31, etc.) contacts count 3 points each;

- Only one contact is allowed via each single-channel FM satellite, UO-14

Photo 4: ON6MP and Dish with UEK3000

(one phone), AO-27 (one phone), SO-41 (one phone), SO-50 (one phone), ISS (one phone and one digital), PCSat (one digital), etc.;

- The use of more than one transmitter at the same time on a single satellite transponder is prohibited;

- Each satellite transponder is considered a separate band. Phone QSO's count for one point, other QSO's (CW, RTTY, PSK31 etc) count for 3 points.

2. Digital Transponders

For the Pacsats (LO-19, e.g., UO-22, etc.), each satellite is considered a separate band. Do not post "CQ" messages. Simply upload *one* greeting message to each satellite and download as many greeting messages as possible from each satellite. The subject of the uploaded file should be posted as Field Day Greetings, addressed to ALL. The purpose of this portion of the competition is to demonstrate digital satellite communications to other Field Day participants and observers. Do not reply to Field Day Greetings addressed to ALL.

The following uploads and downloads count as three-point digital contacts:

(a) Upload of a satellite Field Day Greetings file (one per satellite);

(b) Download of Satellite Field Day Greetings files posted by other stations. Downloads of non-Field Day files or messages not addressed to ALL are not to be counted for the event. Save DIR listings and message files for later "proof of contact.".

Please note that AMSAT uploaded messages do not count for QSO points under the ARRL rules.

Satellite digipeat QSO's and APRS short-message contacts are worth three points each, but must be complete verified two-way exchanges. Remember, only one digipeat contact is allowed for the ISS and one for PCSat.

The use of terrestrial gateway stations to uplink/downlink is not allowed.

If FO-29 is active, the JA transponder can be used for analog CW and phone activities under the analog transponder rules, and the

JD system can be used as a separate transponder under the digital rules.

Sample Satellite Field Day Greetings File:

Greetings from W5BTS Field Day Satellite station near Katy, Texas, with 20 participants, operating class 2A, in the AMSAT-Houston group with the Houston Amateur Television Society and the Houston QRP club. All the best and 73!

Note that the message stated the call, name of the group, operating class, where they were located (the grid square would be helpful) and how many operators were in attendance.

3. Operating Class

Stations operating portable and using emergency power (as per ARRL Field Day rules) are in a separate operating class from those at home connected to commercial power. On the report form, simply check off Emergency or Commercial for the Power Source and be sure to specify your ARRL operating class (2A, 1C, etc.).

And Finally...

The Satellite Summary Sheet should be used for submission of the AMSAT Field Day competition results to:

Bruce Paige, KK5DO
Vice President User Services
PO Box 310
Alief, TX 77410-0310

Make sure to also send your Field Day photographs with your submission! The deadline for submissions is July 20, 2003. You can also send your entry sheet and digital photos via e-mail to kk5do@amsat.org. The first-place emergency power/portable station will receive a plaque at the AMSAT General Meeting and Space Symposium in Toronto, Ontario, Canada, October 17-18, 2003. Certificates will be awarded for second and third place portable/emergency operation in addition to a certificate for the first-place home station that runs on emergency power. Stations submitting the highest, award-winning scores will be requested to send in dupe sheets for analog contacts and message listings for digital downloads.

You may have multiple rig difficulties, antenna failures, computer glitches, generator disasters, tropical storms, and there may even be satellite problems, but the goal is to test your ability to operate in an emergency situation. Try different gear. Demonstrate satellite operations to hams that don't even know that the HAMSATS exist. Test your equipment. Avoid making more than *one* contact via the FM-only voice HAMSATS or the ISS, and enjoy the event! ■

Sample AMSAT Summary Sheet for 2003
(download the Word Processor compatible version from http://www.amsat.org/amsat/activities/amsatfd.html)

Number of Voice QSOs	
Satellite	# of QSOs
UO-14 (example)	1
AO-40 (example)	10
Total Number Voice QSOs:	11

Number of CW/RTTY/PSK31 QSOs	
Satellite	# of QSOs
AO-40 (example)	3
Total Number CW/RTTY/PSK31 QSOs:	3

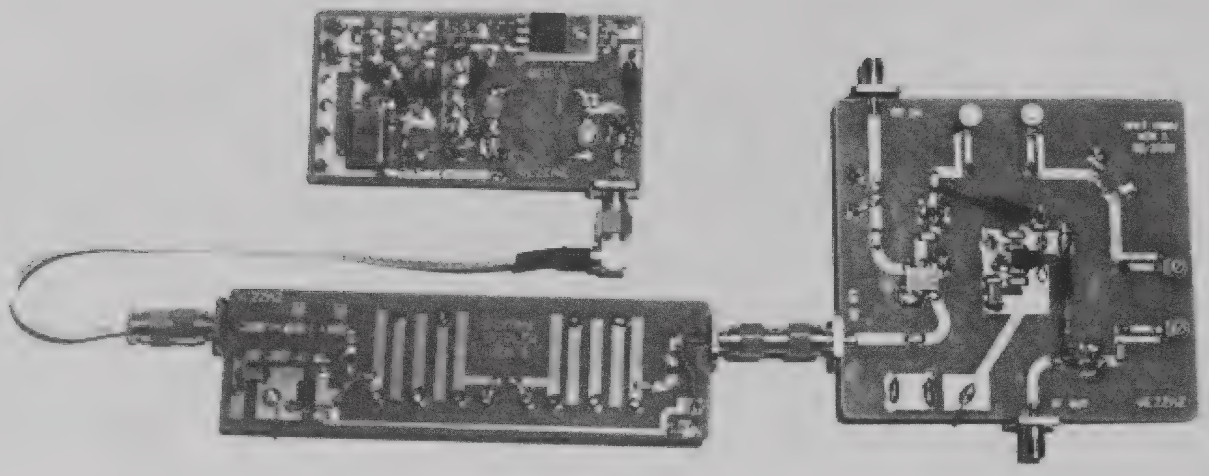
Number of Up/Downloads	
Satellite	# of QSOs
UO-11 (example)	1
Total Number of Up/Downloads:	1

Score Calculation	
Total Number Voice QSOs x 1:	11
Total Number CW/RTTY/PSK31 QSOs x 3:	9
Total Number of Up/Downloads x 3:	3
Grand Total:	33 (example)

Your Field Day Callsign:	
Your Group Name:	
ARRL Field Day Classification	
Power Source (select one)	Emergency Commercial
Your Name and Callsign:	
Home Address:	
Any comments:	

A 1269MHz Transmit Converter With 70cm IF Input

By Bertrand Zauhar, VE2ZAZ
Email: ve2zaz@amsat.org
Website: http://www3.sympatico.ca/b.zauhar



AO-40's Mode L-S is undoubtedly growing in popularity. This mode (1.2GHz uplink, 2.4GHz downlink) will become even more utilized as new satellites (Eagle, Phase 3E, Echo) are launched. Most AO-40 stations use a VHF-UHF transceiver with their S-band downconverter set for a VHF receive IF (for AO-40 mode U-S operation). Consequently, the need for an L-Band transmit converter that uses the UHF band as the transmit Intermediate Frequency (IF) becomes obvious. With such a transmit converter, the same receive downconverter can be used for both modes U-S and L-S.

Designing an L-band transmit converter that uses the 70cm band as the IF input is not trivial. One issue is that the third harmonic of the 70cm band falls right into the Amateur Radio L-Band: 432MHz x 3 = 1296MHz. A solution is to use the high end of the 70cm band, 448 MHz, as the transmit IF frequency. This pushes the third harmonic off to 1344 MHz. Another issue with this type of converter is that the low-side injection Local Oscillator (LO) frequency of 834MHz produces unacceptable mixing products that also fall right into the L-Band. This converter overcomes the issue, by selecting - at 1717 MHz - a LO frequency for high side injection.

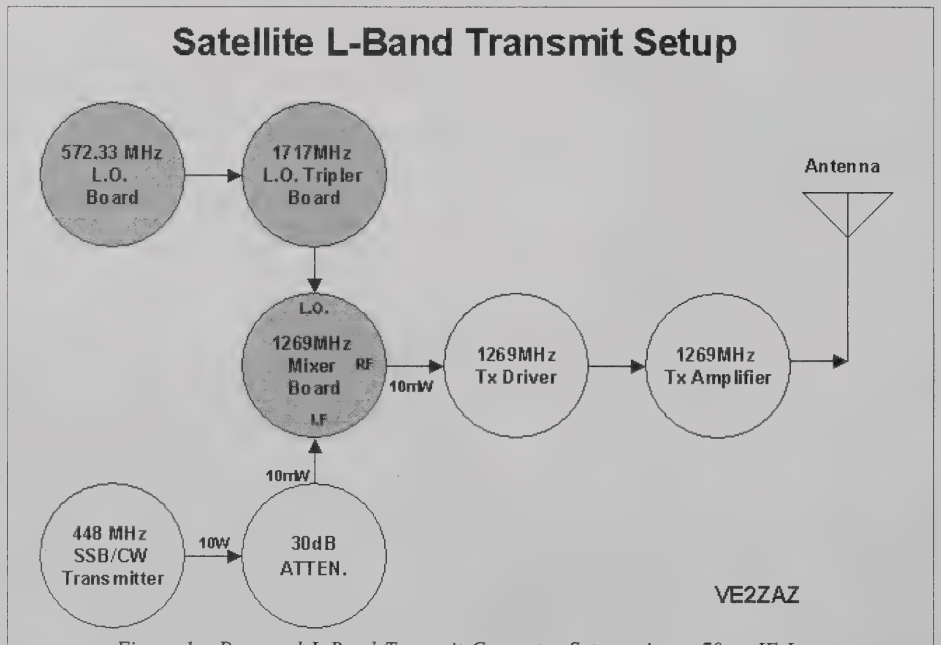


Figure 1: Proposed L-Band Transmit Converter Setup using a 70cm IF Input

Finally, the above solutions can only work if selective bandpass filters are used to attenuate nearby spurious signals. This design uses two tuneable microstrip resonator bandpass filters on the 1269MHz output signal to achieve the required attenuation of the spurious signals.

The resulting transmit converter provides 10mW of RF output at 1269MHz with a 10mW drive at 448MHz. This is suitable for driving commercially available power amplifiers.

The converter is made of three small printed circuit boards[7]: The LO board, the LO tripler board and the mixer board. There are several benefits in breaking down the design into three boards:

- This type of project is easier to develop with a step-by-step approach, and as separate small PCBs;
- It provides the flexibility of using a commercially available LO board;
- It helps reduce coupling and other interactions between the different stages, which might deteriorate performance;
- It simplifies the calibration process and troubleshooting.

As mentioned above, the proposed LO board can be replaced by an existing design such as the KK7B 540-580MHz LO board, which was manufactured by SHF Systems and by DownEast Microwave during the 80's and 90's. While this board can be found,

it is no longer commercially available, hence the proposal of a new LO board in this article.

CONVERTER BLOCK DIAGRAM

Figure 1 shows a block diagram of the proposed satellite L-band Transmit setup. The elements in grey are detailed in this article. The 1269MHz Mixer board (center) is the heart of the system. It accepts a 448MHz IF input provided by a 70cm SSB/CW transmitter through a 30dB external power attenuator. The latter can be made using ordinary axial-lead 2W resistors[1]. The mixer's role is to translate this IF signal to 1269MHz by using a LO signal at 1717MHz.

Mathematically presented:
1717MHz — 448MHz = 1269MHz.

The 1717MHz LO stages consist of a 572.333MHz LO board and a 1717MHz LO tripler board (572.333MHz x 3 = 1717MHz).

The mixer board's R.F. output is sent to an external amplification chain, typically a driver stage and a power amplifier module. These are not developed here as they are available commercially either in a kit form or fully assembled[2].

1269MHz MIXER BOARD DESCRIPTION

Figure 2 shows the circuit schematic of the 1269MHz Mixer board. The circuit's focal point is A1, the mixer module, a Mini-Circuits ADE-11X. The mixer receives the SSB/CW I.F signal from the external UHF transceiver, and 30dB power attenuator via an additional 13dB on-board attenuator and protection diodes. The attenuator brings the input to the mixer at a level of —3dBm. The mixer input side is also fed a 1717MHz LO signal, an unmodulated carrier at a level of +7dBm.

The mixer's output is amplified by 20dB using U2, a Mini-Circuits ERA-3 amplifier. Next, there are two stages of tuned resonator bandpass filter separated by an unpopulated pi-shaped attenuator. The two filters provide the required spurious signals and harmonic attenuation for a clean

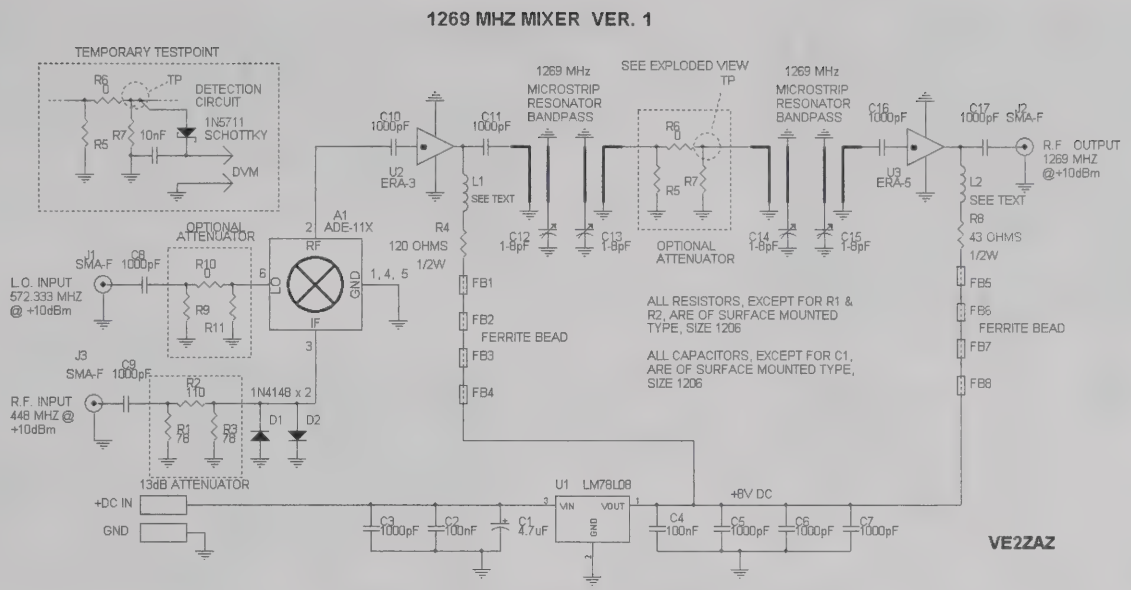


Figure 2: Mixer Board Circuit Schematic

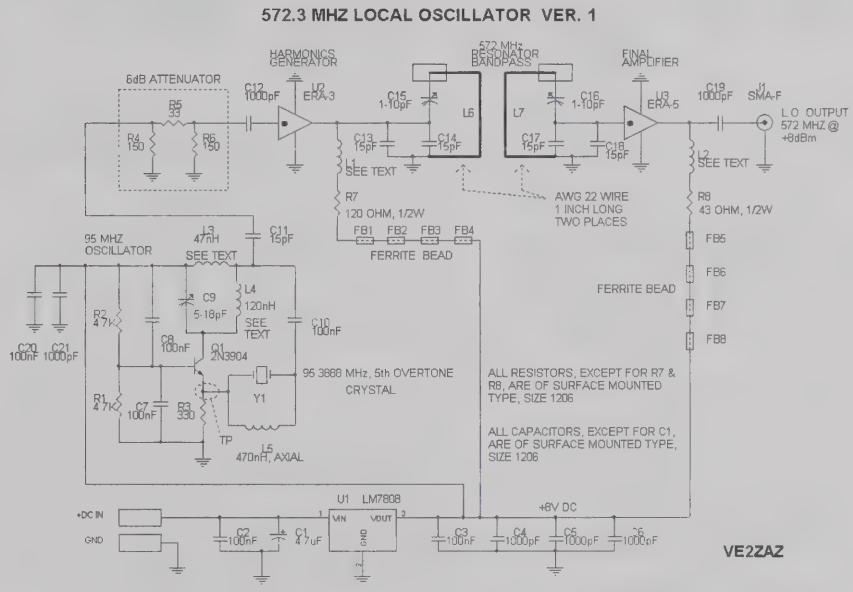

572.3 MHZ LOCAL OSCILLATOR VER. 1
6dB ATTENUATOR
HARMONICS GENERATOR
572 MHz RESONATOR BANDPASS
FINAL AMPLIFIER
95 MHZ OSCILLATOR
95.3869 MHz, 5th OVERTONE CRYSTAL
AWG 22 WIRE 1 INCH LONG TWO PLACES
120 OHM, 1/2W
43 OHM, 1/2W
FERRITE BEAD
L.O. OUTPUT 572 MHZ @ +8dBm
ALL RESISTORS, EXCEPT FOR R7 & R8, ARE OF SURFACE MOUNTED TYPE, SIZE 1206
ALL CAPACITORS, EXCEPT FOR C1, ARE OF SURFACE MOUNTED TYPE, SIZE 1206
U1 LM7808
+8V DC
+DC IN
GND
VE2ZAZ

Figure 3: 572 MHz LO Board Circuit Schematic

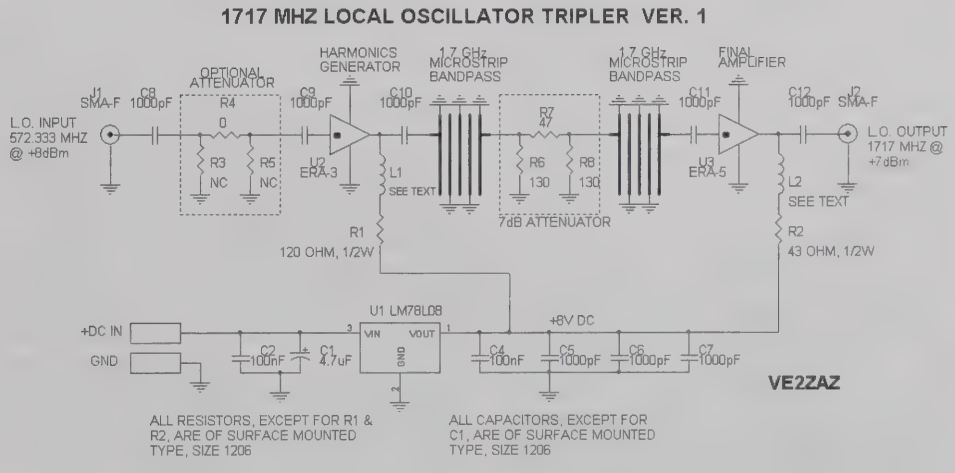

1717 MHZ LOCAL OSCILLATOR TRIPLER VER. 1
OPTIONAL ATTENUATOR
HARMONICS GENERATOR
1.7 GHz MICROSTRIP BANDPASS
FINAL AMPLIFIER
L.O. INPUT 572.333 MHZ @ +8dBm
L.O. OUTPUT 1717 MHZ @ +7dBm
7dB ATTENUATOR
120 OHM, 1/2W
43 OHM, 1/2W
U1 LM78L08
+8V DC
+DC IN
GND
ALL RESISTORS, EXCEPT FOR R1 & R2, ARE OF SURFACE MOUNTED TYPE, SIZE 1206
ALL CAPACITORS, EXCEPT FOR C1, ARE OF SURFACE MOUNTED TYPE, SIZE 1206
VE2ZAZ

Figure 4: 1717 MHz LO Tripler Board Circuit Schematic

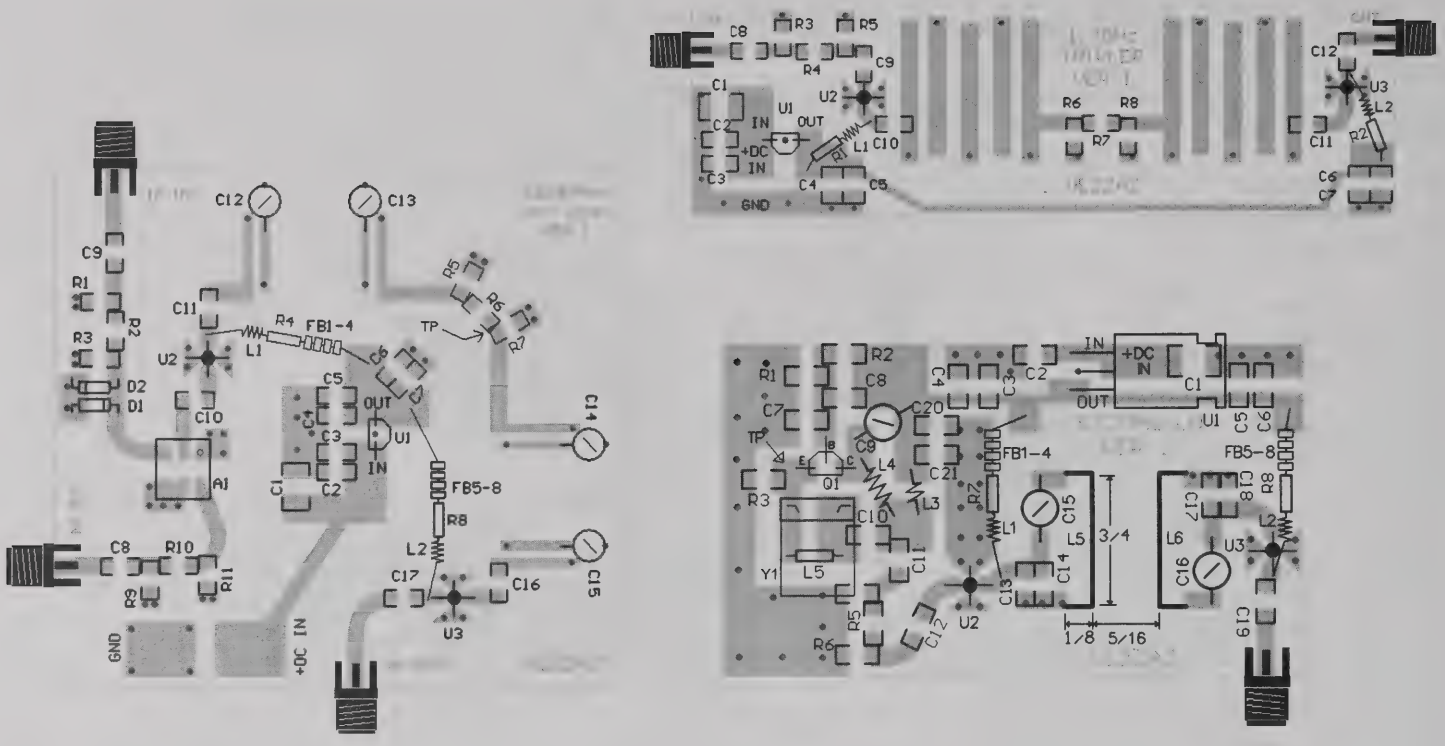


Figure 5: Layout for Mixer Board (left), LO Tripler Board (top-right) and LO Board (bottom-right)

1269MHz output. The final stage provides another 18dB gain using U3, a ERA-5 amplifier. The output is the required +10dBm SSB/CW signal at 1269MHz.

All active components on the board are supplied with a regulated and filtered +8VDC provided by U1, a 78L08 100mA voltage regulator. This voltage is applied through current-limiting resistors and inductors to the ERA amplifiers.

572MHz LO BOARD

As shown in Figure 3, the 572MHz LO board is populated with a 95.3888MHz crystal oscillator. The oscillator uses a common base configuration. The circuit promotes Y1 crystal oscillation in the 5th overtone mode of 95MHz. This is accomplished by C9, L3 and L4 making a 95Mhz resonating LC circuit.

The oscillator's output is sent to the harmonics generator (U2) via a 6dB pi-shape attenuator. The harmonics generator is made of an ERA-3 amplifier driven into saturation. The harmonic-rich output is sent to a tuned resonator bandpass filter made of two wire loops run against the PCB surface, as opposed to using etched microstrip traces. This technique allows a reduction of passband attenuation and an increase of the filter's Q factor. The fact that the filter is of a tuned type drastically reduces its size as well. The filter passes the oscillator' s 6th harmonic, 572.3333MHz, while attenuating other harmonic multiples of 95MHz.

The final stage, U3, provides another 18dB of gain using an ERA-5 amplifier. The output is a clean 572.3333MHz signal with an amplitude of +8dBm.

Active components on the LO board are supplied with +8VDC provided by U1, a 7808 1-Amp voltage regulator.

1717MHz LO TRIPLER BOARD DESCRIPTION

The 1717MHz LO Tripler board circuit schematic is shown in Figure 4. The circuit accepts a 572.3333MHz signal at a level of +8dBm and feeds it into a harmonics generator, U2, made of an ERA-3 amplifier driven into saturation. The harmonic-rich output is sent to two stages of inter-digital microstrip bandpass filter separated by an 7dB pi-shaped attenuator. The two filters pass the 1717MHz component and attenuates other harmonics and spurious signals. The final amplifier stage, U3, provides another 18dB of gain using an ERA-5 amplifier. The output is a clean +7dBm output at 1717MHz.

Active components are supplied with +8VDC provided by U1, a 78L08 100mA voltage regulator.

ASSEMBLY

The following tools are recommended to assemble the boards:

- Tweezers to handle surface-mounted components,
- A fine tip soldering iron,
- A self-supporting magnifier or magnifying lamp.
- A static dissipating mat and accompanying wrist strap.

The converter boards detailed here are built on three small 1/16" thick G10 (glass-epoxy) PCB. All three PCBs have 50 Ohm impedance microstrip transmission lines. On all three PCBs, the topside holds the electronics and the traces; the bottom side has a solid ground plane. Plated-through vias stitch the top side ground points to the bottom ground plane.

Component location for the three boards is shown in figure 5. Parts list are shown in Tables 1, 2 and 3.

Bandpass filter resonators on the mixer board and the LO tripler board are printed as microstrip traces onto the top PCB surface itself. The 572MHz LO board has its

bandpass filter resonators L5 and L6 made of inch-long wire elements. The elements should be bent in a 1/8" by 3/4" by1/8" U-shape, as shown in Figure 5. They are then laid down against the top PCB surface and soldered over the pads with as little overlap as possible. This will result in a wire-to-wire spacing of approximately 5/16".

1206-size surface-mount capacitors and resistors are used everywhere. Nowadays, they are inexpensive and their parasitic inductance and capacitance are reduced compared to leaded components. This is important when working above 500MHz. All surface-mount capacitors and resistors are provided by the PCB supplier. [7]

SMA-female connectors are soldered to the PCB edges at shown locations. If cost is an issue SMA connectors and cable for linking the LO board to the LO Tripler board may be replaced with a short piece of coaxial cable. The center conductor gets soldered to the edge of the PCBs, right on the trace. The shield is then soldered to the ground plane, directly under the PCB trace.

Soldering of the components should be performed in the following order: SMA connectors; capacitors and resistors; inductors; voltage regulators; crystal. Soldering of the active RF devices (RF amplifiers, transistor) should be performed only after proper +8V supply regulation is verified.

Installation of the ERA amplifiers should be performed in the following manner. It is recommended that you use a static-dissipating mat and a wrist strap, as the amplifiers are ESD sensitive. First, pre-tin all four PCB pads. Then drop the amplifier in place and line up the pins with the traces. Make sure that the input pin is properly positioned; it is marked with a dot on the package and the pin tip is cut at an angle. First solder the two ground pins to the PCB pads. Then solder the remaining two pins. Care should be taken not to overheat the amplifier leads.

Each ERA amplifier has its supply fed via a resistor-inductor combination. It is actually made of an axial 1/2 watt resistor and an RF choke wound using one of the resistor leads. The other resistor lead holds several ferrite beads that act as additional RF blockage (in the case of the 1717MHz tripler board, the ferrite beads are not required). The inductor end can be soldered at the 1000pF SMT output-coupling capacitor. The opposite resistor lead gets soldered to the PCB supply pad.

Pi-shape resistive attenuators are inserted in several locations on the boards to balance RF levels and reduce overload. Resistor values shown in the schematics are those recommended for typical applications. Also note that the resistive attenuators shown as optional should simply be bypassed with a 1206-size 0 Ohm resistor (also known as jumper). As an alternative, a copper strap of 1/10" width, installed flat against the PCB and in line with the traces, can be used.

On the 572MHz LO board, both the crystal (Y1) and the voltage regualtor (U1) are suspended by their leads above the board surface. Care should be taken so that their bodies do not touch other components underneath. Note that the voltage regulator does not require heat sinking.

Additional assembly details can be found on the author's website[3].

TUNING AND TESTING

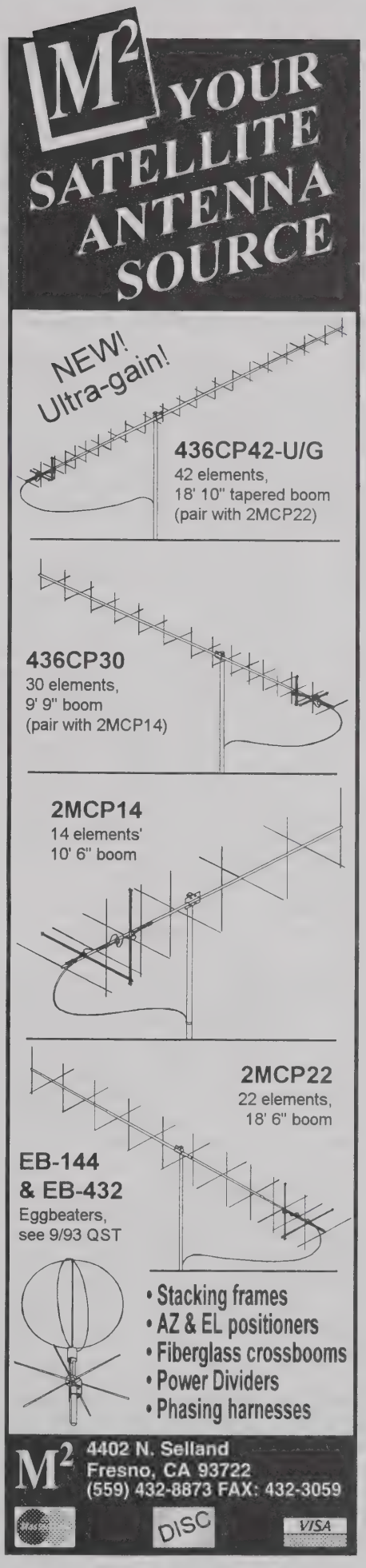
The following tools are useful to properly adjust and test this project:

- A Digital Voltmeter (required),
- An RF Voltmeter or equivalent (required, see workaround below),
- A non-conductive tuning screwdriver (required),
- A RF frequency counter (desirable),
- A RF generator (optional),
- A RF Spectrum Analyser (optional).

The RF Voltmeter is an asset for the radio experimenter. On the used market at hamfests, one can purchase this item for $100 or less. If none are available to the user, it is possible to make a basic one for a few dollars. An SMA-female PCB-mount connector, a 1N5711 Schottky diode, a pair of 100 ohm 1206-size surface-mount resistors and a 10nF capacitor are all that is required. Visit the author's website[3] for more details.

A note of caution before going any further: Always disconnect the supply to the converter boards before disconnecting RF cables. The ERA amplifiers are somewhat sensitive to open-circuit operation and may fail if their output is unterminated. This is especially true with this design since they are run at high output levels.

The first step in testing any electronic circuit is to check the supply voltage. All three boards provide a regulated +8VDC to the various stages. Apply a DC voltage of at least +11V (+14V typical) to the "+DC IN pads". Use the bottom-side ground plane to connect the negative wire. Verify +8V



presence before installing the ERA amplifiers.

After ERA installation, verify the 572MHz LO board operation as follows. Connect the RF voltmeter (with built-in 50 ohm termination) at the RF output connector. Apply DC voltage to the board. Begin by measuring the DC voltage at the output pin of U2, the ERA-3 amplifier. You should measure around +3.6VDC. Also verify U3, the ERA-5 for approximately +4.9VDC.

Next, connect your digital voltmeter (DVM) probes across R3 (point shown as TP on schematic) and adjust trimcap C9 until you measure a slight drop of voltage, typically 0.1V. Adjust the trimcap back and forth until you reach the minimum voltage. This is the "sweet spot" that provides oscillation.

The last adjustment step on the 572MHz LO board involves tuning the bandpass filter. Slowly adjust trimcaps C15 and C16 until you are able to measure RF at the output connector. This may take a while as the optimum adjustment point is somewhat narrow. Alternate adjustment between the two trimcaps until you maximize the reading on the RF voltmeter. You should normally measure at least +8dBm of RF output. Re-adjust C9 if necessary to achieve the required output. Connect a frequency counter (with proper attenuation added) to the RF output connector and verify for a frequency of 572.333MHz. This will confirm that you have tuned the bandpass filter to select the right harmonic. Disconnect DC supply.

Interconnect the LO board's RF output with the LO tripler board's RF input. Connect the RF voltmeter to the LO Tripler board's RF outpout connector. Apply DC supply only to the Tripler board. Verify proper biasing on the ERA amplifiers on the 1717MHz Tripler board. Next, apply power to the LO board. No adjustments are required on the Tripler board. Simply adjust LO board trimcap C9 again for an output of around +7dBm at 1717MHz. In doing this, you are actually slightly "de-tuning" the oscillator's tank circuit in order to control oscillation amplitude. Disconnect the supply to both boards, then reconnect it to verify that oscillation starts up again with the right amplitude.

Finally, test the mixer board for proper operation. To ease tuning of the 1269MHz bandpass filters, you should implement a temporary detection circuit, as shown on the circuit schematic in the exploded view of figure 2. This allows you to tune the first stage more easily. Solder the anode end of a 1N5711 Schottky diode to the signal trace near R6. Then solder a 10nF capacitor between the diode's cathode and the ground pad of R7. Keep the diode leads short. Connect the diode-to-capacitor junction point to the + lead of the DVM and connect the DVM's — lead to ground. This will act as an RF detector.

Connect the LO tripler's RF output to the input marked "LO IN" on the Mixer board. Also connect your 448MHz RF source to the "IF IN" port on the Mixer board. This can be your UHF transmitter with at least 30dB of attenuation or it can be a signal generator. Connect the RF Voltmeter to the RF OUT connector on the Mixer board.

Apply DC power only to the Mixer board. Verify proper biasing on the ERA amplifiers on the Mixer board. Next, apply power to all three boards. Turn on your RF source to provide a +10dBm steady carrier into the mixer board. For transmitter users, recall that 10W into a 30dB attenuator makes 10mW, or +10dBm. Slowly adjust C12 and C13 to maximize the DVM reading. As earlier, this may take a while as the optimum adjustment point is somewhat narrow. Alternate adjustment between the two trimcaps until you maximize the reading on the DVM. When finished, disconnect the DC supply from all boards, unsolder the anode side of the schottky diode and lift it away from the trace.

Next, reconnect the DC supply to all three boards. Adjust C14 and C15 in the same

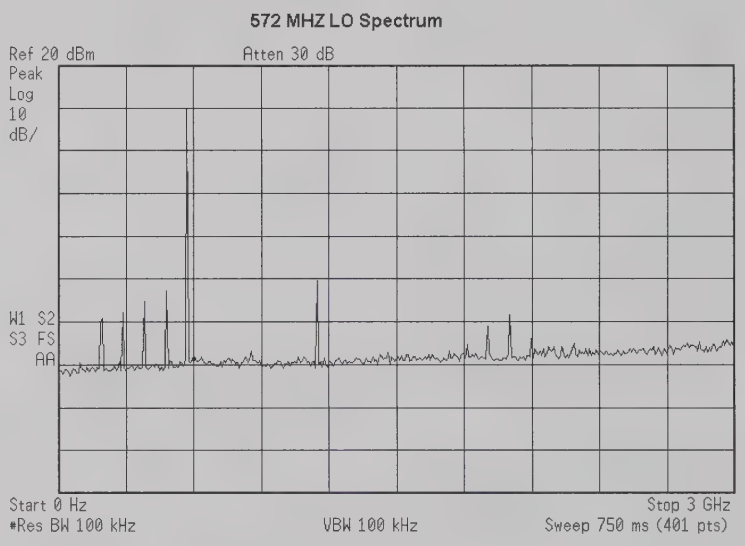


Figure 6a: Spectrum Content of the LO Board

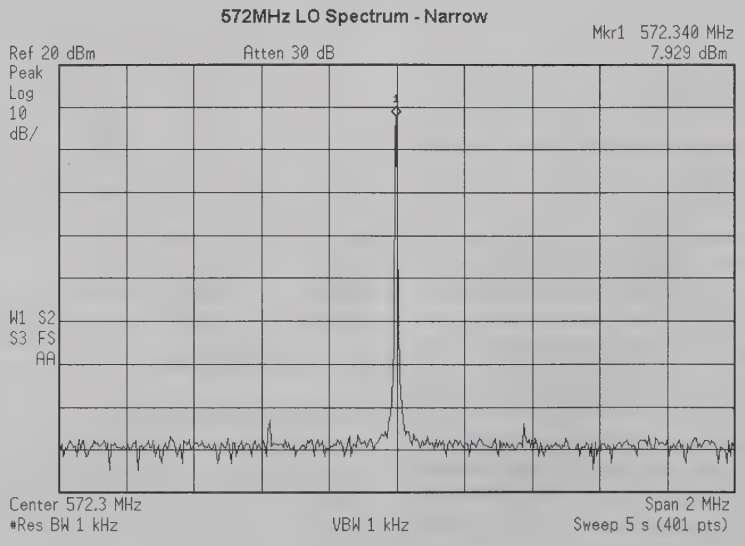


Figure 6b: Spectrum Content of the LO Board

manner as above to optimize the output on the RF voltmeter (at output connector). Touch up C12 and C13 again to optimize the RF voltmeter reading. Touch up C14 and C15 again. The adjustments are now over. You should register approximately +10dBm of output power at 1269 MHz.

Pi-shape attenuator resistor values shown in the schematics are the ones recommended for typical applications. Nevertheless, users with good RF knowledge might want to change attenuation values[8] to adjust levels and better suit their application.

PERFORMANCE

Figures 6a-6e show spectrum contents of the three board outputs. The 572MHz LO has all of its harmonics and spurious signals reduced at least 40dB below the carrier. The 1717 MHz Tripler has all of its harmonics and spurious signals down at least 35dB below the carrier.

The most important plot (Figure 6e) shows that the 1269 MHz output has its spurious signals and harmonics attenuated to at least 40dB below the +10dBm nominal output level. Note that the 1717MHz LO gets through at a constant —42dBm, regardless of the 1269MHz output level. This performance is fully acceptible. Moreover, the added external amplifier stage filters will contribute to the reduction of undesired spurious signals and harmonics.

The 1dB compression point of the 1269MHz output was measured at +11dBm.

Inter-modulation distortion (IMD) two-tone tests with 500kHz spacing have shown that the third-order products are 45dB below the reference single-tone level of +10dBm (39dB below the two-tone level). Fifth order products are 60dB below the single-tone reference level.

Finally, a subjective listening test was performed using an Icom IC-PCR1000 as the receiver. SSB audio quality at the receiver's end appeared to be good. Furthermore, CW sounded clean, with no audible ripple.

Note that due to spectrum inversion resulting of high side LO injection, the opposite sideband mode must be selected on the UHF transmitter to obtain the desired transmitted SSB. In other words, a Lower Sideband signal transmitted into the 448 MHz IF port will result in an Upper Sideband output at 1269MHz, and vice-versa. As well, note that an increase in UHF input frequency

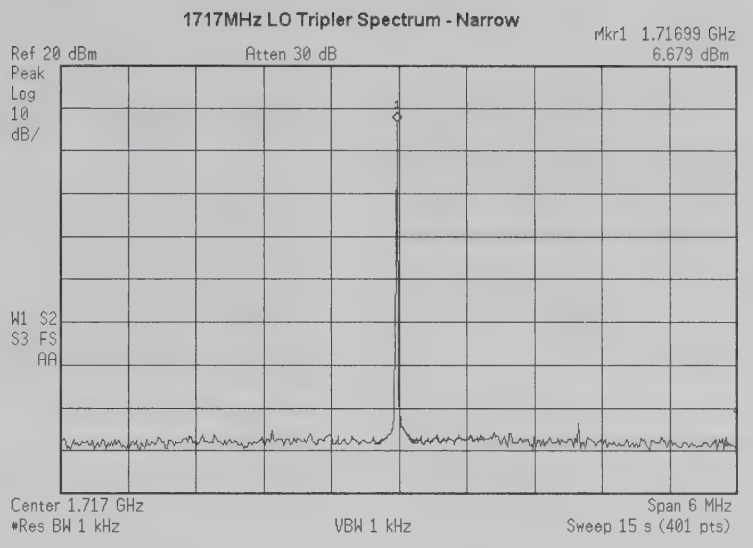


Figure 6c: Spectrum Content of the Tripler Board

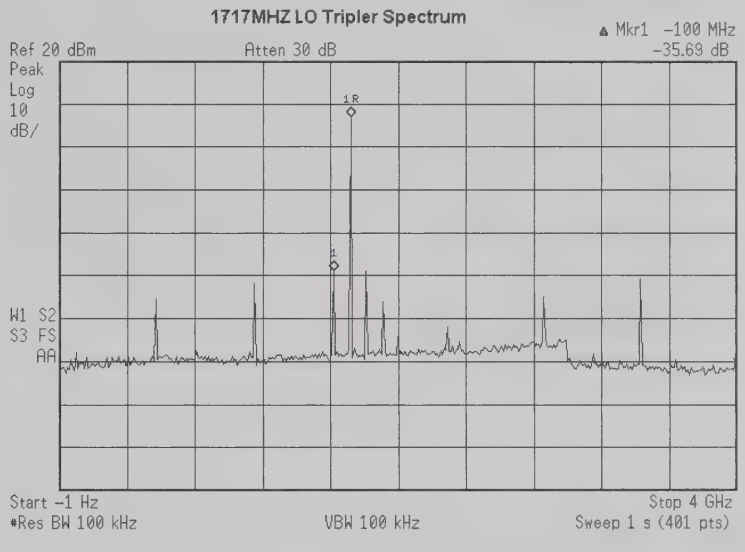


Figure 6d: Spectrum Content of the Tripler Board

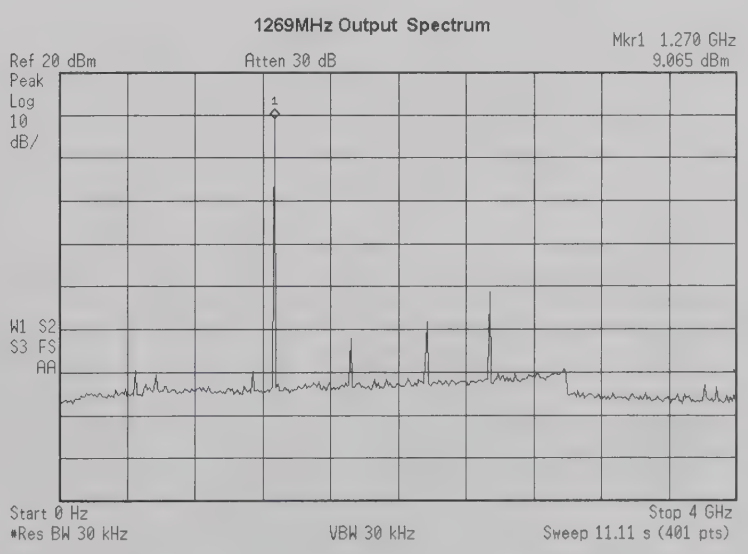


Figure 6e: Spectrum Content at the Output Frequency

will translate into a decrease in L-Band output frequency.

One can expect the 95MHz oscillator frequency to drift until the crystal temperature is stable. This drift will translate into a 1269MHz signal drift of 18 times greater, since 95.3888MHz x 18 = 1717MHz. To prevent this, plan on a warming time of 15 to 30 minutes. To help improve stability, the 575MHz LO board can be wrapped in thermally insulating material. Moreover, the entire converter can be left powered at all times.

A final caution will be to avoid overdriving the RF output beyond the +10dBm level. This would cause excessive compression on the signal and would deteriorate IMD performance.

ACKNOWLEDGMENT

The author would like to express his gratitude to Jacques Audet, VE2AZX. Jacques's support in RF filter design combined with his valuable advice helped make this long-term project a reality.

SPECIFICATIONS

- **RF input:** 447-450MHz signal @ +10dBm maximum, any modulation mode.
- **RF output:** 1267-1270MHz signal @ +10dBm +/- 2dB, linear conversion, spectrum inverting.
- **Conversion gain:** 0dB typical.
- **1717MHz LO input level:** +7dBm +/ - 1dB.
- **Third Order products:** -45dB from two-tone reference level, measured at +10dBm nominal output level.
- **Output spurious signals and harmonics:** -40dBc or better, at +10dBm nominal output level.
- **1dB output compression point:** +11dBm.
- **DC input voltage range:** +11V to +20VDC.
- **DC input current:** 350mA maximum (all three boards powered).

NOTES

1. The author also proposes a simple design for a DC-500MHz, 40W, 30dB attenuator on his website. Refer to note 3 for VE2ZAZ's website address.

2. Mitsubishi Electronics make hybrid amplifier modules that will take a 10mW L-Band drive and amplify it to 18W. These modules and accompanying electronics can be purchased from DownEast Microwave (http://www.downeastmicrowave.com). Also consult the ARRL literature for L-band amplifier construction articles.

3. VE2ZAZ's amateur radio website's address is: http://www3.sympatico.ca/b.zauhar

4. ERA-3 and ERA-5 amplifiers and the ADE-11X mixer can be ordered directly from Mini-Circuits Laboratories (http://www.minicircuits.com). Even though their website stipulates that minimum order is $100, the company will actually ship smaller orders. Considering their low cost, ordering additional amplifiers as spares is recommended.

5. The 95.3888MHz crystal can be ordered from crystal manufacturers such as Jan Crystals, ICM or West Crystals. Price is typically $20 plus tax and shipping. Crystal equivalent-model characteristics are: C_0 = 5.8pF, C_1 = 0.6pF, L = 5.0mH, Q = 80,000.

6. Surface-mounted chip capacitors and resistors, trimcaps, voltage regulators, axial resistors, diodes, transistor and SMA connectors can be purchased from Digikey (http://www.digikey.com) .

7. The set of three bare PCBs can be ordered from FAR circuits for $36 USD plus shipping. The PCBs are pre-drilled, tinned, have plated-through vias and component marking.All chip capacitors and chip resistors required for this project are also supplied with the PCBs. Please visit the website http://www.farcircuits.net for more details.

8. Resistive attenuator design formulas are very well summarized at this website address: http://williamson-labs.com/attenuator.htm. ■

Table 1: Mixer Board Parts List

Qty	Designation	Description	Qty	Designation	Description
1	A1	Mini-circuits ADE-11X mixer[4].	1	R2	110 Ohms, chip, 1206 size
1	C1	4.7uF, 25V Tantalum	1	R4	120 Ohms, axial, 1/2W
4	C12, C13, C14, C15	1-3pF, ceramic variable capacitor (trimcap), 0.200" lead spacing. Sprague-Goodman GKG3R015 or equiv.	4	R5, R7, R9, R11	Resistors not populated.
2	C2, C4	100nF, chip 1206 size	2	R6, R10	0 Ohms, chip, 1206 size. Copper strap 0.1" wide as substitute.
10	C3, C5, C6, C7, C8, C9, C10, C11, C16, C17	1000pF, chip 1206 size	1	R8	43 Ohms, axial, 1/2W
2	D1, D2	1N4148 silicon diode	1	Temporary testpoint	1N5711 Schottky diode
8	FB1-FB8	Ferrite bead. J.W. Miller FB64-110	1	Temporary testpoint	10nF, axial or radial
3	J1, J2, J3	SMA-Female, PCB mount, gold plated	1	U1	LM78L08 voltage regulator, 100mA max.
2	L1, L2	Leads form resistors R4 and R8, wound with one-wire spacing, on 1/16" inside diameter, Typically 4 turns are possible.	1	U2	Mini-circuits ERA-3 MMIC amplifier[4].
2	R1, R3	78 ohms, chip, 1206 size	1	U3	Mini-circuits ERA-5 MMIC amplifier[4].

Table 2: LO Board Parts List

Qty	Designation	Description	Qty	Designation	Description
1	C1	4.7uF, 25V Tantalum	2	L6, L7	1 inch long of AWG-22 (diameter 0.025") solid copper, U-shaped as 1/8"-3/4"-1/8".
5	C11, C13, C14, C17, C18	15pF, chip 1206 size	1	Q1	2N3904 NPN transistor, TO-92 case
2	C15, C16	3-10pF, ceramic variable capacitor (trimcap), 0.200" lead spacing. Sprague-Goodman GKG10015 or equiv.	2	R2, R1	4.7 KOhms, chip, 1206 size
6	C2, C3, C7, C8, C10, C20	100nF, chip 1206 size	1	R3	330 Ohms, chip, 1206 size
6	C4, C5, C6, C12, C19, C21	1000pF, chip 1206 size	1	R5	33 Ohms, chip, 1206 size
1	C9	6.5-30pF, ceramic variable capacitor (trimcap), 0.200" lead spacing. Sprague-Goodman GKG30015 or equiv.	2	R6, R4	150 Ohms, chip, 1206 size
8	FB1-FB8	Ferrite bead. J.W. Miller FB64-110	1	R7	120 Ohms, axial, 1/2W
1	J1	SMA-F Female, PCB mount, gold plated	1	R8	43 Ohms, axial, 1/2W
2	L1, L2	Leads form resistors R7 and R8, wound with one-wire spacing, on 1/16" inside diameter. Typically 4 turns are possible.	1	U1	LM7808 1-Amp. voltage regulator.
1	L3	47nH. 3 turns of AWG-22 (Æ0.025") solid enameled copper wire closely wound on 1/8" inside diameter.	1	U2	Mini-circuits ERA-3 MMIC amplifier[4].
1	L4	120nH. 7 turns, shaped identical to L3.	1	U3	Mini-circuits ERA-5 MMIC amplifier[4].
1	L5	470nH, axial inductor	1	Y1	95.3888 MHz, 5th overtone, parallel resonant[5].

Table 3: LO Tripler Board Parts List

Qty	Designation	Description	Qty	Designation	Description
1	C1	4.7uF, 25V Tantalum	2	R3, R5	Resistors not populated.
2	C2, C4	100nF, chip, 1206 size	1	R4	0 Ohms, chip, 1206 size. Copper strap 0.1" wide as substitute.
8	C5, C6, C7, C8, C9, C10, C11, C12	1000pF, chip, 1206 size	2	R6, R8	130 Ohms, chip, 1206 size
2	J1, J2	SMA-Female, PCB mount, gold plated	1	R7	47 Ohms, chip, 1206 size
2	L2, L1	Leads form resistors R1 and R2, wound with one-wire spacing, on 1/16" inside diameter. Typically 4 turns are possible.	1	U1	LM78L08 voltage regulator, 100mA max
1	R1	120 Ohms, axial, 1/2W	1	U2	Mini-circuits ERA-3 MMIC amplifier[4].
1	R2	43 Ohms, axial, 1/2W	1	U3	Mini-circuits ERA-5 MMIC amplifier[4].

AO-40 Reception In The S2 World

By Lee McLamb, KU4OS
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Shortly after launch, information was published regarding the expected performance of the AO-40's various transmitters and the systems that would be needed on the ground for adequate reception. These early articles were based on the availability of the S1 transmitter and its high gain antenna. Unfortunately the S1 transmitter fell silent in August of 2001 and subsequent testing has not lent any hope for its return. Based on the reality of having the S2 transmitter as our primary downlink and differences between the planned and actual orbit, this article will update the required receiving configuration needed for AO-40.

The good news is that even with the lower gain of the S2 transmitter and antenna system on board the satellite, a modest receiving set-up will still produce excellent results. In order to get those results though very close attention must be paid to the two most critical factors under our control, antenna gain and system noise. Neglecting either one is almost guaranteed to result in a system that makes hearing the other stations on the satellite difficult if not impossible.

In satellite and microwave communications the receiving system figure of merit is often expressed as "G/t". The value "G" represents the antenna gain converted from the usual decibels to a ratio. The term "t" is the total system noise temperature in Kelvin. The advantage of using G/t is that one value for the required level of performance can be specified. The User is then free to choose values of antenna gain and noise that are best suited to their individual situation. Another advantage is that G/t can be determined by comparing the additional noise seen with the dish pointed at the Sun to the noise pointing at a quiet point in the sky. By measuring both Sun noise rise and Ground noise rise it is possible to know both your actual antenna gain and total system Noise Figure.

Table 1 is based on values published previously in the AMSAT Journal [1]. Recent measurements made at several stations using various techniques have verified those numbers. The only adjustment that was needed was to show the lower S2 antenna gain and an increase in path loss due to the higher apogee.

I've included two sets of values. One column shows the full 23 dB signal dynamic range available when only one receiver is connected through to the S2 transmitter. However, the most common operating mode is with the U-Rx, L1-Rx and L2-Rx all connected. As a result, the additional receiver noise reduces the available dynamic range to 18 dB, which I have shown in the last column.

Initially I started with a Drake downconverter rated at 27 dB of gain and a 3db Noise Figure (NF). For an SSB bandwidth of 2400 Hz the noise power of my downconverter was —140.2 dBm. At the time I also had an 18-inch dish with just 19 dBi of gain. I could hear the strongest stations, but it was a real struggle to copy voice with barely a 7 dB SNR. At this point I decided that my goal would be to be able to hear everything on the transponder. I reasoned that using the transponder noise floor is a good guide since if the satellite can't hear them I won't work them. It also provides a good benchmark for the point of diminishing returns. The 3-Rx noise floor is —169.8 dBm, which means I would need at least 29.6 dB of antenna gain or a much quieter front end to meet my goal.

To express this as a G/t value, first the 3db NF is converted to its noise temperature of 289 Kelvin. Then the required dish gain of 29.6 dB is converted to a ratio of 912. G/t = 912/289 = 3.16. Converting to decibels yields 5.0 dB. Any combination of Gain and Temperature that has this ratio will result in the same performance. Based on this, table 2 shows some of the various combinations.

Two important things to remember about the Table 2. You must include the total system noise. This will always be higher than the NF quoted by the preamp or downconverter manufacturer due to sky noise, spill over

Table 1

	1 Receiver On	3 Receivers On
PEP S2 Transponder	50.0 watts	50.0 watts
Satellite Antenna	10.0 dBi	10.0 dBi
Satellite EIRP	57.0 dBm	57.0 dBm
PEP/QSO (-13db/ca)	44.0 dBm	44.0 dBm
2.4 GHz Path Loss @ 60k km	195.6 dB	195.6 dB
PEP-Ground	-151.6 dBm	-151.6 dBm
QSO Dynamic Range	23.0 dB	18.2 dB
Received Transponder Noise	-174.6 dBm	-169.8 dBm
Required G/t	9.8 dB	5.0 dB

Table 2

Total Receive System Noise			1 Rx On 9.8 G/t		3 Rx On 5.0 G/t	
Noise Figure (dB)	Noise Temp (K)	2.4Khz Noise Power (dBm)	Gain (dBi)	Dish Size (Feet)	Gain (dBi)	Dish Size (Feet)
3.0	288.6	-140.2	34.4	10	29.6	6
2.0	169.6	-142.5	32.1	7.5	27.3	4
1.5	119.6	-144.0	30.6	6	25.8	
1.0	75.1	-146.0	28.5		23.8	3
0.7	50.7	-147.7	26.8	4	22.1	
0.6	43.0	-148.5	26.1		21.3	2
0.4	28.0	-150.3	24.3	3	19.5	18 inch

Table 3: Formulas		
Noise Temperature (Kelvin)	T=290*10NF/10 -1	NF = System Noise Figure (dB)
Noise Power(Watts)	PNoise = kTB	k=1.3807*10^{-23} (Bolzmann's Constant) T= Noise Temperature (Kelvin) B=Bandwidth (Hertz)
Path Loss(dB)	-32.45 + 20Log(Freq) + 20Log(Dist)	Freq=Frequency (MHz)Dist=Distance (km)

and connector losses. Second, the dish gains are for right hand circularly polarized antennas. If you are using a linearly polarized antenna, you will need to subtract 3 dB from the stated antenna gain to account for losses due to polarization mismatch. Another way to use the second table is to subtract the noise floor from the PEP-Ground value in the first table. This will give the expected signal to noise ratio for voice QSOs. The thing which was the biggest surprise to me and which you can clearly see in table 2 was that a one decibel change in Noise Figure results in more than a one decibel change in the signal to noise ratio.

Having figured out several possible combinations, I started out by adding a Down East Microwave preamp in front of the downconverter. The preamp NF is specified as < 0.7 dB. Once installed at the feed of my 18 inch dish, my total system Noise Figure dropped from 3 dB to 0.9 dB giving me a 7 dB improvement in my receive. This proved to be a pretty effective combination. But there were still times that I would lose stations into my local noise floor and I knew there was room for improvement. My latest step has been to move up from an 18-inch dish to a 3-foot dish. With the additional 6 dB of antenna gain I can now detect the transponder noise floor at most reasonable squint angles. One additional benefit is that I since I'm no longer struggling to find my own downlink; it is much easier to avoid drawing LEILA's attention. The best part is that instead of struggling, almost all QSOs are armchair copy. Now operating on AO-40 with its DX coverage and leisurely passes for rag chewing is very enjoyable.

Reference

1. AMSAT Journal, March/April 2001, page 26

ARISS Gets the Spotlight at Science Teachers Gathering

Student-to-astronaut communication via ham radio got a boost from ARRL Education and Technology Project Coordinator Jerry Hill, KH6HU, during the National Science Teachers Association national conference. Hill helped to staff the NASA booth during the gathering March 27-30 in Philadelphia.

Accompanying Hill at the Philadelphia Convention Center was ARRL Education and Technology Program teacher Jim Kuhl, N2STK. Kuhl is a "Big Project" pilot program teacher at Central Square Middle School in New York. "Jim was a big help," Hill said. "He's made an ARISS contact before and had Amateur Radio right in his classroom. Having him there lent tremendous credibility to the program."

During the NSTA gathering, more than 14,000 secondary school instructors had a chance to learn about ARISS, an international project with participation by ARRL, AMSAT and NASA. Among other benefits, ARISS provides an opportunity for students to talk directly with crew members of the International Space Station (ISS) – a unique educational experience. ARISS also is responsible for the Amateur Radio equipment at NA1SS, the first permanent ham radio station in space onboard the ISS.

A former industrial arts teacher, Hill said the teachers he spoke with were very enthusiastic about the ARISS program, especially once they realized that direct contact with the ISS was a real possibility. "They get pretty excited at that point," he said. "It just blows their minds."

Hill says he hopes more Education and Technology Program pilot school teachers will be able to join him in the NASA-sponsored booth at future conventions. In the future, he'd also like to see students demonstrate Amateur Radio.

[Thanks to the ARRL for the above information.]

■

Dale Hershberger, KL7XJ, in Soldotna, Alaska, uses a **SatEL Az-*EL!*** to mount a 3' N3IYR circular polarization offset dish for his AO-40, 2.4 GHz downlink, and a M2 70 cm 11 element Yagi for his uplink. Dale is about to install a DEM RHCP helix for a 1.2 GHz uplink.

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Prior Planning - Key to a Successful DX Cruise

By Allen Mattis, N5AFV

As printed in April 2002 **Worldradio Magazine,** *used by permission*

Could a new satellite operator successfully conduct a DX operation from a cruise ship? It was a little over a year ago on July 16, 2000, that I made my first amateur radio satellite contact. A few weeks earlier I had seen a satellite demonstration by Bruce Paige, KK5DO, at Field Day. When I was first licensed in 1978, I thought I wanted to work satellites, but I did not get around to it until Bruce piqued my interest. I soon became active on the FM satellites, UO-14, AO-27 and SO-35. I had been working the satellites for about a year when my wife and I began making plans for a Caribbean cruise, and I decided to take the opportunity to work the satellites from the cruise ship. I wanted the operation to go well, so I put a great deal of effort into the planning and preparation, just like the "big guns" do for a major DX-expedition.

My first step was to investigate licensing requirements, and determine where I would be able to operate. In order to operate maritime mobile from a ship, it is necessary to obtain a license from the country in which the vessel is flagged, and to have permission of the captain of the ship. The ship we had booked was the Ocean Princess, flagged in the United Kingdom. A visit to the American Radio Relay League (ARRL) web page (http://www.arrl.org/FandES/field/regulations/io/) indicated that the European Conference of Postal and Telecommunications Administration (CEPT) agreement T/R 61-01 gives US amateur radio operators operating privileges in the United Kingdom. I would still have to obtain permission from the captain to operate amateur radio from the ship, but I had crossed the first hurdle.

I also began to investigate operating from the various islands we were scheduled to visit. Again, the ARRL web page was extremely helpful. The CEPT agreement also included permission to operate from Curacao in the Netherlands Antilles. An International Amateur Radio Permit (IARP) available from the ARRL would give operating privileges for Isla Margarita, Venezuela, so I promptly applied to the League for an IARP. I knew that my US license was valid in St. Thomas in the US Virgin Islands. Information was also available for obtaining a reciprocal license from The Bahamas. Both Richard Long, W4AKE, and Al Lee, WA4EWV, were helpful in providing me with assistance during the application procedure, and I filed an application with the Public Utilities Com-mission in Nassau. In some cases it may take several months for reciprocal license applications to be processed, so it was important to apply well before my scheduled departure. Other plann-ed stops on the cruise were Barbados and Dominica, but since our stops were for only one day, and reciprocal licenses had to be applied for in person after landing on those islands, I decided to pass on obtaining licenses to operate from those islands.

The author, Allen Mattis, N5AFV shown testing the radio before the cruise

The gear

My next step was to determine what equipment to take on the cruise. I sent E-mail to John Sheets, N8QGC, and Ramon Santoyo, XE1KK, who had both operated on cruises during the past year, and asked for suggestions and recommendations. Both John and Ramon responded with excellent suggestions and help. John had operated on his cruise with an Arrow handheld beam, but after the terrorist attacks of September 11, 2001, we live in a different world. While operating satellites in the Houston metropolitan area after September 11th, I was frequently questioned by police and security guards attracted by my Arrow beam antenna. Therefore, I felt that I would not be allowed to operate from the ship with an Arrow antenna. On his cruise, Ramon had successfully operated with a Premier AL800 telescoping antenna and an HT. I decided to go that route, and the AL800 and my Icom IC-W32A HT became my choice of equipment. In case the AL800 antenna was not allowed due to security reasons, I selected an MFJ-1717 high gain dual band rubber duck antenna to be my backup antenna. Most cruise lines prohibit the playing of radios on deck because they disturb other passengers, so I decided to use an MFJ-288I headset with my HT. I also planned to take along a small, voice activated tape recorder to record the passes so that I would not have to log the contacts by hand. It would be difficult to write down contact information on a windy deck, in the dark, or in the rain, and the tape recorder would solve that problem. Next, I purchased a Garmin GPS unit. The GPS unit would give my exact position and grid square, give the exact time in UTC, and tell me what direction the ship was heading so that I would know which side of the ship to operate from. Both the tape recorder and the GPS unit use AA batteries, so I planned to take along a generous supply of batteries. My final equipment decision dealt with how to obtain satellite pass predictions during the cruise. I decided to travel light and not take along a lap top computer or Palm Pilot. I ran satellite pass predictions for the entire cruise at home using Nova for Windows on my home PC, and printed out hard copy sheets to take along.

Now that my equipment was selected, I began to check out the equipment and become familiar with it. I read the Icom IC-

W32A instruction manual from cover to cover, even though I planned to take the manual along. I noticed a few minor problems with my IC-W32A, and decided to send it to Icom for servicing. In my cover letter to Icom, I explained how I planned to use the IC-W32A on an upcoming cruise, and Icom went over the entire radio to make sure that it was operating within specifications. I found that my HT battery packs were beginning to show their age and did not hold a full charge as long as they used to, so I purchased two new battery packs. I decided to take along three battery packs for the HT, a drop-in charger, and a trickle charger. I was very cognizant that Mr. Murphy would probably pay me a visit, and I planned backups for critical equipment such as the battery charger and antenna. An Icom HM-54 speaker microphone would be an acceptable backup for the MFJ headset. Because Icom had just serviced my IC-W32A, I did not plan on taking along a backup radio.

My final preparation consisted of making practice contacts with the equipment I planned to take on the cruise. I used the IC-W32A and AL800 antenna to make approximately 75 contacts under a variety of conditions during the month before the cruise. The practice operation continued until five days before my scheduled departure. This proved to be very important, because on the final day of practice operation, both Tony Campbell, W5ADC, and Bruce Paige, KK5DO, reported that my audio was very low. A test of the MFJ-288I headset indicated that it was not working properly, and I quickly obtained a replacement headset to take along on the cruise. I hadn't left for the cruise yet, but Mr. Murphy had made his first visit.

A few days before departure, I called Continental Airlines, to find out how the new security regulations would affect the transporting of amateur radio equipment on an aircraft. I was told that transporting the IC-W32A HT should not be a problem if I could turn it on and show that it worked, and had my amateur radio license along. I was also told that the Premier AL800 antenna would have to be transported in checked baggage because it could be taken apart and used as a weapon. In addition, it was prohibited to carry most tools in carry-on baggage, so my emergency tool kit consisting of two screw drivers and a needle nosed pliers was also destined for checked baggage. Dave Paperman, W5WP, also suggested to me that extra battery packs for the HT be carried in checked baggage, because they could not be opened to show that they did not contain prohibited materials. I finalized my plans for packing — the HT with one battery pack and its regular rubber duck antenna, the MFJ-1717 high gain dual band rubber duck antenna, the trickle charger, the GPS unit, and the tape recorder would travel in carry on baggage. All other radio gear and related equipment would go into checked baggage. This distribution of equipment provided the ability to operate if the checked baggage was lost.

The trip from Houston to Florida went without incident. We moved through the security checkpoints with absolutely no problem, and arrived at the departure gate approximately 20 minutes after being dropped off at the airport. The flight was on time, and when we arrived in Florida, our ride was waiting. We stayed with relatives that night, and I took the opportunity to check my radio equipment by operating a UO-14 evening pass. I was totally surprised when I did not hear the bird — there was dead silence. What was wrong? The times shown in my computer printout indicated that the satellite should be present, but Mr. Murphy appeared to be present instead. I logged onto the Internet and went to the Heavens Above web site (http://www.heavens-above.com/). I soon determined that the pass times on my printout for Florida were incorrect. I spot-checked my printouts for other locations on the cruise, and the pass times appeared to agree with those in Heavens Above. It appeared that only the pass times for Florida were erroneous. Mr. Murphy had failed to inflict any serious damage.

Boarding the ship

The next day we boarded the ship. Security was just like the airport, and my carry-on baggage passed through without a hitch. After our bags were delivered to our stateroom, we unpacked. All radio gear arrived intact and was ready for use. The next step was to obtain permission to operate on the ship. I inquired at the Purser's Desk if it would be possible to meet with the radio officer, and was told that, due to security, I would have to send a written request to the radio officer. I was handed a piece of paper and envelope, and I permission to operate. In the letter, I stated that I was an amateur radio operator with a US license, and had obtained reciprocal licenses to operate on four of the islands we would visit. The radio I would use was a battery powered handheld unit with a maximum power of 5 watts. The radio used a telescoping antenna 34 inches long, and I would use a headset during operation so that I would not disturb other passengers. In response to my request, a letter was delivered to my stateroom giving written permission to operate, but not at full power. Since power seemed to be a sensitive issue with the radio officer, I located the ship's VHF antennas on the upper deck. I did not want to operate near the ship's antennas because I did not want to take the chance that my transmissions would interfere with the ship's radio system.

Hello, Mr. Murphy!

I was ready for my first satellite pass as a maritime mobile. It was an evening pass, so it was dark. It was also windy and raining, and there were five-foot seas. As a result, there were almost no passengers on deck to witness this momentous occasion. I turned on the radio, and within a minute I could hear the satellite. I turned on the tape recorder and made my first call. Bruce, KK5DO, was my first contact, and I proceeded to work nine different stations in that pass. I was excited when I returned to my stateroom. I turned on the tape recorder to transfer the log to paper, and heard nothing. The tape recorder played, but had not recorded the pass. What happened? Mr. Murphy was back. Before panicking, I decided to put fresh batteries in the recorder.

The author shown operating aboard ship

Now the recorder worked. Apparently it takes more power to record than play, and with weak batteries, the pass had not been recorded. I remembered the calls I had worked and the approximate times, so no damage had been done. The recorder worked fine, and Mr. Murphy had been defeated again. Fortunately, this was the last time Mr. Murphy visited me on the cruise.

Lots of QSOs

During the next ten days I operated 34 satellite passes, and made a total of 235 contacts from 21 grid squares. These totals include operating at sea, and operating from Curacao, Venezuela, US Virgin Islands, The Bahamas, and from Florida on the day we docked. Contacts were made with stations in Canada, United States, Mexico, Costa Rica, Cuba, Puerto Rico, US Virgin Islands, Trinidad and Brazil. I also operated 6 other satellite passes, but made no contacts. It was frustrating to operate from grid squares GK02 and GK03 east of the Windward Islands and hear myself in the downlink, but have no one else on the bird.

Another rewarding aspect of ham radio on the trip was working a number of local operators on two-meter repeaters as we sailed among the islands. It was nice to talk with these local residents and find out more about the islands. Like hams almost anywhere, the local operators were very friendly and welcomed me to their part of the world.

After I returned home, John, N8QGC, sent me a tape he made of the satellite passes when he worked me. It was very instructive for me to hear how the passes sounded in Michigan using a good antenna. I could hear stations calling me on the tape that I did not hear using the AL800 antenna. After listening to the tape several times, I estimate that I could have made as many as 50% more contacts on some of the passes if I had used an Arrow antenna. Another noticeable occurrence was that many stations gave their call signs rapidly without using phonetics. I had difficulty on the ship copying these call signs, and it was not much easier on John's tape. If these stations had used phonetics and slowed down just a little, it would have also increased the number of contacts I made. Despite these lessons learned, ham radio operation on the cruise was certainly a success. The attention given during planning and preparation paid off. I plan to take a cruise again someday, and ham radio will be part of it. ■

AMSAT President Addresses SARS Concerns for Annual Meeting

To All AMSAT Members,

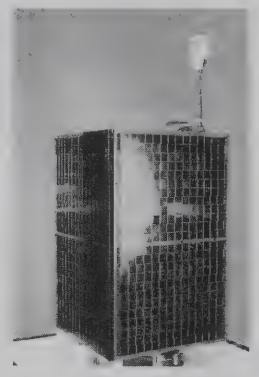
As your President, I am reviewing the situation for the location of the 2003 Annual Meeting and Space Symposium. Currently this is due to be held in Toronto later this year in October.

The outbreak of SARS in Toronto has caused some worry by travelers to and from Toronto, but let me assure you that at present the SARS outbreak appears to be under control and is being limited to a few health care facilities.

Should the situation change for the worse, then we will make a change (Washington, DC and Orlando are being considered) however current indications are that within a month the situation will have changed for the better and that we will continue with Toronto.

As of May 2, 2003 it was 3 weeks since any member of the Toronto general public has been confirmed with a case of SARS. The number of people in isolation is reducing as their isolation time expires and it would appear that the situation is improving everyday. I will provide additional information on a regular basis".

73
Robin Haighton VE3FRH
President AMSAT ■



UO-14

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AMSAT Satellite Operator Awards

By Bruce Paige, KK5DO
AMSAT Awards Manager and VP User Services

Operating on a satellite is a lot of fun. Not only do you get to speak with people all over the world but you also collect a lot of interesting QSL cards. With those confirmed QSL cards, you can collect a few pieces of wallpaper. Actually, you can collect a lot of wallpaper. Awards come in many different flavors, some sponsored by AMSAT, some by the ARRL and others sponsored by other countries.

If you are looking for an easy place to start, the natural first step is AMSAT's Satellite Communicators Club certificate. In fact, the only thing you have to do to earn this certificate is to make your first satellite contact. This is the only award that does not require a confirmed QSL card. Just send the info about your contact to AMSAT Awards Manager Bruce Paige, KK5DO, at his callbook address. The cost is $1 for members and $2 for non-members.

AMSAT
The Radio Amateur Satellite Corporation

THIS IS TO CERTIFY THAT

IS A MEMBER STATION OF THE

SATELLITE COMMUNICATORS' CLUB

AND IS ENTITLED TO ALL THE PRIVILEGES, PREROGATIVES, RIGHTS, FAVORS, GLORY, RANK, FAME, NOTORIETY, POPULARITY, AND HONOR OF MEMBERSHIP IN THAT WORTHY ORGANIZATION.

AWARD MANAGER

Another award from AMSAT is the Oscar Satellite Communications Achievement Award. This award is for 20 confirmed contacts with a station in another state, DXCC country or Canadian call area. If you work six VE3s then you can only submit one of them towards this award. These contacts can be on any satellite or mode. To submit for this award, send copies of both sides of your confirmed QSL cards to AMSAT Awards Manager, Bruce Paige, KK5DO. The cost is $3.50 for members, $5 for non-members. Also send two units of postage for your return certificate.

OSCAR SATELLITE COMMUNICATIONS ACHIEVEMENT AWARD

AWARDED TO:

The Radio Amateur Satellite Corporation

DATE NUMBER AWARD MANAGER PRESIDENT

Along these same lines are the Oscar Sexagesimal and the Oscar Century awards. The Sexagesimal Award requires the previous 20 confirmed contacts plus another 40, for a total of 60. The Oscar Century Award is for 100 confirmed contacts, which includes the 60 from the Sexagesimal Award. Both of these awards are submitted to the AMSAT Awards Manager.

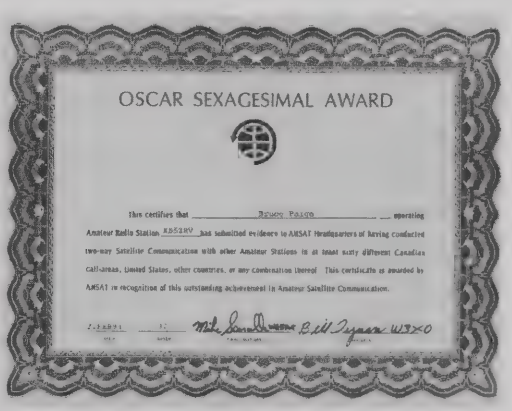
South Africa sponsors the South Africa AMSAT Satellite Communication Achievement Award. This award is for 25 confirmed satellite contacts on any Phase 2 satellite. These satellites include Fuji-Oscar 20/29, AO-21 (no longer operational), AO-27 and RS-10/12/15. The costs for this award are the same as for the previous AMSAT Awards and are also submitted to the AMSAT Awards Manager.

The next AMSAT award is the W4AMI Satellite Operator Achievement Award. This award requires no confirmed QSL cards but does take a bit of recordkeeping. You get credit for each 1,000 satellite QSO's up to 5,000. Please submit your log (computer generated or handwritten) to KK5DO at his callbook address. The cost is $3.50 for members, $5 for non-members. Also send two units of postage for your return certificate.

The ARRL also sponsors several awards. They are the Worked All States (WAS) Award with Satellite endorsement, the VHF/UHF Century Club (VUCC) Award, the DX Century Club (DXCC) Award and Worked All Continents (WAC) Award.

For Worked All States, you must work someone in each of the 50 states through any amateur satellite in any mode. For the VHF/UHF Century Club Award, you must work someone in 100 different grid squares. Endorsements are available for every 25 grid squares after the first 100. The final award, DXCC, requires you to make a satellite QSO with 100 different DXCC countries. For Worked All Continents, you work someone on each of the eight continents. More information on these awards can be found on the ARRL's website: http://www.arrl.org. Once there click on Operating Awards.

Finally, I would like to introduce the newest AMSAT Award, which starts with contacts on or after November 1, 2001. The award is the AMSAT Elmer Award. The complete rules for this award are as follows.


OSCAR SEXAGESIMAL AWARD

Amateur Radio Station

two-way Satellite Communications with other Amateur Stations in at least sixty different Canadian call-areas, United States, other countries, or any combination thereof. This certificate is awarded by AMSAT in recognition of this outstanding achievement in Amateur Satellite Communication.

The award has three levels, Beginner, Intermediate and Expert.

Any satellite may be used for these contacts but contacts must be made by Voice or CW. No packet contacts allowed. Contacts with the ISS, Shuttle or any other manned spacecraft are not to be used for this award.

Contacts must be made on or after November 1, 2001. Call signs may be used only once. Therefore, if a call sign fits multiple categories, it is your choice within which category you claim it. For example, my daughter Mahana, W5BTS, could be claimed for YL op, Young Op. School Club

A certificate is available for $3.50 for AMSAT members, $5 for non-AMSAT members. Two units of postage are required for return of your certificate.

SA AMSAT
SATELLITE COMMUNICATION
ACHIEVEMENT AWARD
This award is made in recognition of having made twenty-five two-way contacts through Phase II Satellites.
AWARDS MANAGER
AWARD NUMBER

Moving on, various magazines, countries and ham groups also have other awards. There is even one from Russia, the Cosmos Award. Check around and you'll find several of these all worth pursuing. As for the AMSAT or ARRL Awards, I would be happy to answer any questions you have. Please send them to me via snail mail or the preferred method, email to kk5do@amsat.org

73 and good luck on chasing your favorite award. ■

call signs count only towards the School Club category.

No QSL cards are required; however, random checks with the operators listed will be performed.

To apply for the award submit your list in date/time order with the following information for each contact:
Call Sign/Date of Contact/Time of Contact/ Satellite/Category. Send it to the AMSAT Awards Manager, KK5DO.

For "category" please use these abbreviations:
YL for YL ops contact
Teen for Young ops
First for 1st Contact
New for ops less than 2 years
School for School Club Station

Call Sign	Date	UTC	Satellite	Category
ZZ2ZZ	05 Nov 2002	0300	UO-14	YL
ZZ1ZZ	06 Nov 2002	0415	UO-14	YL
ZZ1ZY	06 Nov 2002	0425	AO-10	Teen
ZZ1ZX	07 Nov 2002	0530	AO-10	First
ZZ3ZX	07 Nov 2002	0530	AO-10	New
ZZ4AA	08 Nov 2002	0400	UO-14	School

Recommended format for the AMSAT Elmer award submission

Requirements for AMSAT Elmer Award Beginner, Intermediate, and Expert Levels

Beginner Level	Intermediate Level (includes contacts from Beginner Level)	Expert Level (includes contacts from Intermediate Levels)
Work 1 School Club Station	Work 2 School Club Stations	Work 3 School Club Stations
Work 4 YL Ops	Work 8 YL Ops	Work 12 YL Ops
Work 4 Young Ops (16 and younger)	Work 8 Young Ops (16 and younger)	Work 15 Young Ops (16 and younger)
Work 10 Ops that have had their license for less than 2 years at the time of contact	Work 15 Ops that have had their license for less than 2 years at the time of contact	Work 25 Ops that have had their license for less than 2 years at the time of contact
	Work 2 Ops as their '1st satellite contact' (ever, not just on a particular satellite)	Work 4 Ops as their '1st satellite contact' (ever, not just on a particular satellite)

AMSAT President's Letter *By Robin Haighton, VE3FRH, President AMSAT-NA*

Greetings to all AMSAT Members,

It is always a pleasure to write this monthly letter to you and to try and keep you informed and updated on the various aspects of AMSAT-NA. Firstly let me comment on the status of Echo, our satellite that we hope will be launched later this year. Progress is good, and we hope to have the satellite under test during the late spring or early summer. Final testing prior to shipment will be carried out in our new facility at NASA's Goddard flight Center. I said "new facility" but in fact it is the same facility that we had many years ago when AMSAT first came into existence. Your Executive Vice-president Rick Hambly and Astronaut Ron Parise worked together to reacquire this building, close to the visitors center at Goddard for AMSAT's use. Rick Hambly will be at the Dayton Hamvention as one of the speakers at the AMSAT Forum, he will be giving a detailed update on Echo. Place Forum Room 1, Date Saturday May 17, Time 8.30 am.

The design concepts of the structure of Eagle have been completed and limited work is continuing based on our available income for this project. We have purchased the two Earth Sensors that were subject of a Financial Challenge, issued at Fort Worth and have designed the Can-Bus internal communication system for use in Eagle. The Can-Bus Boards will be first flown on P3E by AMSAT-DL and various other organizations are looking at the AMSAT-NA design to determine if it would meet their requirements. This system will also be the subject of a paper at our Dayton Forum when Bdale Garbee will be presenting a paper on the topic.

Gould Smith will present a Satellite Beginners paper at Dayton. Remember Saturday May 17 in Forum Room 1, 8.30 AM. Dayton is an excellent time to renew your membership, and this year in addition to membership we will have some Premiums which are available to donors. These include the AMSAT Journal CD-ROMs, *Instant*Track (Y2K compatible version) and a surprise premium to everyone who joins or renews their membership.

This is your event and I look forward to meeting each one of you during that weekend. Although I am tempted to spend a lot of time at the Flea Market, I will spend most of the weekend at the AMSAT booth - so do plan to meet me there! I am delighted to confirm the AMSAT EchoLink conference system is now operational. Once more Paul Williamson has made it happen; use EchoLink to discuss satellites, orbits, and to have a round table discussion. Thank You Paul.

Finally, AMSAT is about to hold our first Fund Raising of the Year, as we usually do in May, and while I appreciate that "times are tough" so they are also for the AMSAT building fund. We really do need to progress with Eagle and to provide all the promises that I have put forward, such as (Mode B) - your help is the main way to get there - some new ideas on fund raising will appear in this *Journal* - Please read the Apogee View by guest writer Bill Tynan - Chairman of the Board of Directors.

73,
Robin Haighton, VE3FRH,
President ■

Continued from Page 10

Telemetry

OSCAR-11 Report

Oscar-11's 145.826 MHz. Beacon was heard transmitting continuous ASCII telemetry from 30 March to 07 April. During this period good signals were received. Telemetry transmissions are expected to resume around April 20 for about 8 - 9 days.

The attitude is now being controlled solely by the passive gravity boom gradient, and there is no control over spin rate. The continuous telemetry has enabled the spin period to be calculated from the X & Y magnetometer readings. The spin period has varied between 342 and 505 seconds. The attitude is normal.

Users of OSCAR-11 should note that the date in the telemetry is advanced by three days. The time is advanced by 18 minutes.

OSCAR-11 now operates in a default mode, controlled by the watch-dog timer. The satellite transmits continuous ASCII telemetry for about 8 - 9 days on 145.826 MHz., followed by about 10 - 12 days of silence. These times appear to be somewhat variable, and this regular sequence might be interrupted by ground control.

The mode-S beacon is *on* continuously, even when the VHF beacon is *off*, nominally transmitting an unmodulated carrier on 2401.5 MHz. There is however a *very* low level of AFSK modulation, (now a constant 1200 Hz. audio tone), which has been detected on strong signals. Telemetry indicates that the beacon has partially failed, and is delivering half power. This beacon is a useful test source for those testing mode-S converters, as an alternative to OSCAR-40. However the signals are very weak, and there is a lot of Doppler. Users should also note that the polarisation of OSCAR-11 is LHC. Even if you can't hear OSCAR-11, your equipment may still be OK for OSCAR-40. Any reports of reception on 2401.5 MHz would be most welcome. Please e-mail g3cwv@amsat.org.

The 435.025 MHz. beacon is normally *off*. It can only be heard on the very rare occassions when the satellite is being commanded by ground control, ie. within range of Guildford, UK. When the 435 beacon is transmitting, the 145 beacon is normally *off*. The data transmitted is mainly binary.

Listeners to OSCAR-11 may be interested in visiting the web site at http://www.users.zetnet.co.uk/clivew/

73 Clive G3CWV g3cwv@amsat.org ■

AO-40 Update

We are about to begin active magnetorquing to hold ALON relatively steady and begin to lower ALAT. Current ALON/ALAT is approximately 330/25, but better determination will be possible once the ALAT drops below about 15 degs. and the earth enters the camera field of view.

We hope to have the passbands on during the first half of the orbit within about 1 week, if all goes well.

The A-blk "message of the day" section now includes height, Lon/Lat of the subsatellite point, and ALON/ALAT. All of these values are generated by the IHU-1 software based on its orbital and magnetorquing calculations. ALON/ALAT is also updated from the ground when a new magnetorquing command is issued.

W4SM for the AO-40 command team ■

Continued on Page 30

Continued from Page 29

Telemetry

PCSAT Nearly QRT

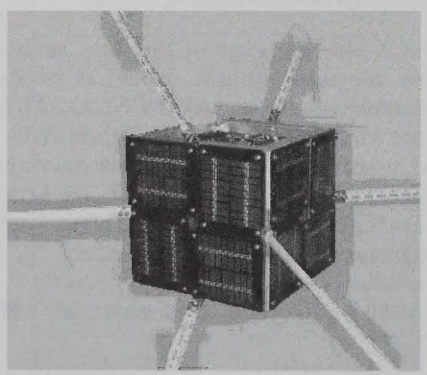
PCsat is back in eclipses and its batteries are practically shot. On April 26, 2003 it went back to negative power budget and so it can now barely even work in the sun due to the peak power needed for each packet burst. The only packets that can possibly get through even while PCsat is in the sun are *very short* as Mic-E formatted packets or Kenwoods which can contain a callsign, position, course and speed with only 9 bytes in the payload. That's about a 0.2 second data burst. Unfortunately the TXD on PCsat defaults to 300 ms and so it is sending 0.3 seconds of overhead to send just 0.2s of data. But that 1/2 second packet is about all you can get through now.

Also, since the UHF receivers default to ON, and they listen for 9600 baud packets, you can really get some short packets through that way too. Just set your D7 or D700 to 9600 baud and split band operation. You can also transmit up on 1200 baud and use the DIGI path of VIA XBAUD and your 1200 baud packet will come back down at 9600 baud, also making a very short packet.

For all practical purposes except for experimenting with these short packets, I'd say PCsat's mission for providing a continuous availability of an AX.25 digipeater for UI packets on 145.825 is over. The next full sun isn't till July 12th and thats another 1000 deep cycles on the batteries.

I hope other satellite designers are considering adding such transponders in the future to continue this "easy-sat" technology. See the PCsat WEB page at:
http://www.ew.usna.edu/~bruninga/pcsat.html

WB4APR@amsat.org, Bob ■



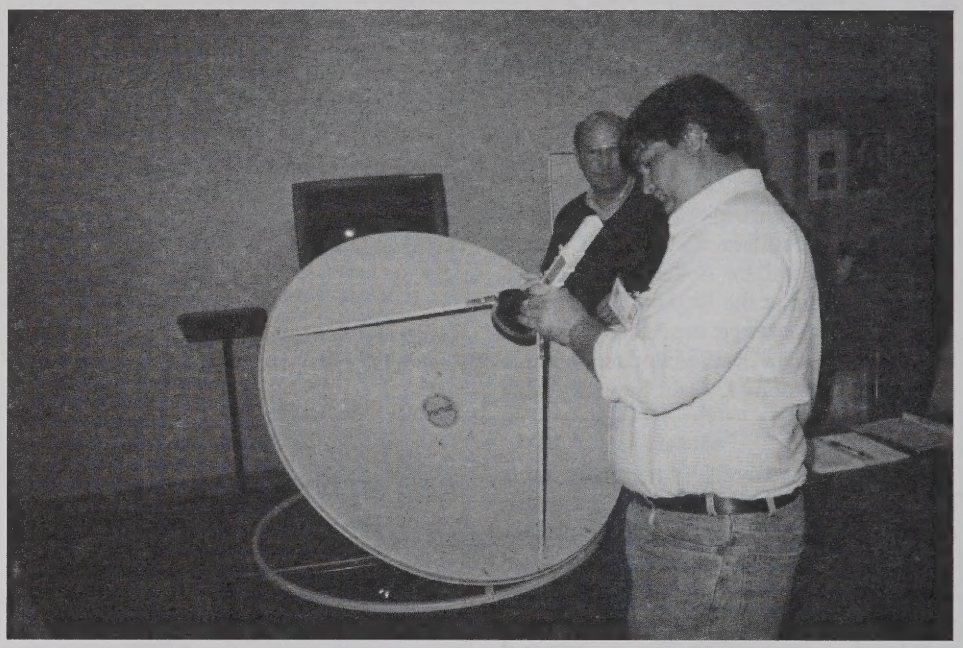
NO-44 PCSat

AMSAT Field Activities Update

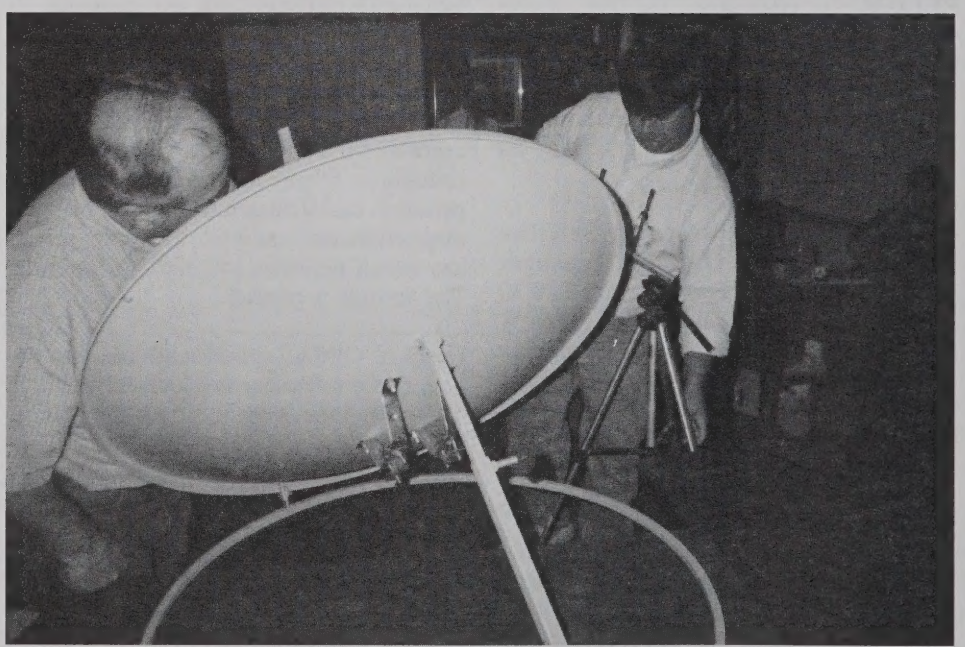
The *AMSAT Journal* is interested in publishing news and photos of your satellite activities. Let the other Amateur Radio operators know what you have been doing. We are interested in hearing from you about satellite activities such as:

- Club demonstrations
- Hamfests
- International, national and local AMSAT activities

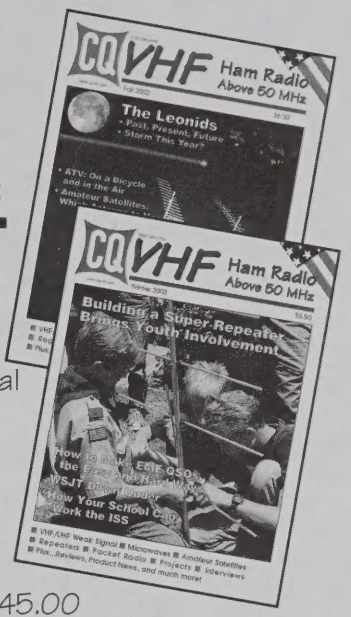
Please send your information to our e-mail address journal@amsat.org. Plain text e-mails work just fine; if you use a word processor then MS-Word format works best. Photos can be in GIF, JPG, or TIF format. ■



This month, Drew Glasbrenner, KO4MA (in the white shirt, above) sent photos of his AO-40 demonstration at the Clearwater (Florida) Amateur Radio Society. (N4ZQ photos)



You should be reading the NEW CQ VHF Ham Radio Above 50 MHz



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